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Chicago Electrical Show Proves a Noteworthy Success

Elaborate Decorative and Lighting Effects Are Features of Show—All Branches of Industry Make Representative Exhibit of Electrical Products

AFTER being without an electrical show for eight years Chicago came back into its own again with a show that eclipses by far all its former attempts at making a display of electrical products.

The most striking features of the show, which opened at the Coliseum Oct. 11 and which will continue until Oct. 25, are the lighting and decorative effects. They are conceded to be the most elaborate that have ever been used in connection with any electrical show. The whole scheme of decoration is typically Chinese in effect and centers about a pagoda, 60 feet high, which graces the exhibition. This pagoda is ornamented with 18,000 "Novagem" jewels which were originally a part of the famous "Tower of Jewels" at the Panama-Pacific Exposition at San Francisco, Calif., in 1915. The pagoda is brilliantly illuminated with searchlights and forms a beautiful centerpiece around which the exposition booths are grouped. The decorative effects of the latter are secured by means of smaller Chinese pagodas, bamboo-thatched roofs, lanterns, sunshades, paintings and the like. Gold and dull red are the predominating colors in the scheme of decorations.

Chinese Pagoda Which Forms Centerpiece at Chicago Electrical Show.

The lighting effects are secured by means of searchlights and floodlights together with numberless Chinese lanterns, the latter serving to subdue the high intensity of the units and in combination with the dull colorings make the exhibition very pleasing to the eye. The lighting effects and decorative scheme were designed by W. D'A. Ryan, director of the Illuminating Engineering Laboratory of the General Electric Co., who also designed those at the Panama-Pacific Exposition.

The immensity and completeness of the exhibition can perhaps be better realized when it is stated that the Coliseum, in reality

Exhibit of Residential Lighting Units and Show Window Lighting at Chicago Electrical Show.

a very large exposition building, appears rather small to the casual observer.

Over 100 electrical manufacturers are represented at the show, and their varied exhibits serve to indicate the progress made in the industry since the last show was held in Chicago eight years ago. This progress is particularly noticeable when one stops to consider that at that time Mazda C lamps, multiplex telegraphy and wireless telephony were unknown, and such devices as enclosed switches, electric furnaces and heating apparatus, industrial reflectors, electrotherapeutic apparatus and electric cooking utensils were in the early stages of development.

To do full justice to all the exhibits is not possible with limited space. The following notes are the result of disinterested observation of what seemed to be the most striking developments exhibited.

Wireless Telephony and Multiplex Telegraphy.

The most recent development of the electrical art to be exhibited at the show is that of wireless telephony. The U. S. Signal Corps has installed a station and conversations are carried on with a station in one of the downtown office buildings. Phonograph music is transmitted by wireless telephony from the latter station to the Coliseum and there amplified so those in attendance at the show may hear. Conversation is also transmitted to stations at Ludington, Mich., and Milwaukee, Wis.

Multiplex telegraphy, by means of which four messages may be sent in each direction over a single wire at the same time, is shown by two interconnected machines exhibited by the Western Electric Co.

Lighting Equipment.

The many exhibits of manufacturers of lighting equipment augment the lighting effects of the show proper. Prominent among these is an exhibit showing a comparison between modern and antiquated method of industrial lighting. Two shops identical as to machinery, benches, etc., have been equipped, one with modern lighting units and the other with old-style units, such as cluster and unshaded drop lights. The comparison is so striking, as one walks from one room to another, that it effectively convinces any one of the advantages of good industrial lighting. In connection with this display, which is made by Commonwealth Edison Co., is a clever scheme for showing the illuminating value of a dozen or so different makes of industrial lighting units. Large plats showing the light distribution curves for all of the units are placed directly under the corresponding units themselves. When one of the latter is in operation, one can tell not only from the unit in question but from its distribution curve what the characteristics of the particular reflector or lighting unit are. Good show-window lighting is illustrated by an actual window display alternately illuminated with old-style equipment and with modern reflectors; also the use of daylight Mazda lamps for bringing out color values is illustrated by a display alternately illuminated by Mazda "C" units and by daylight Mazda lamps.

The evolution of the modern lamp is shown in an exhibit of the National Lamp Works of General Electric Co., types of lamps from prehistoric times up to the new "White Mazda" being displayed. In connection with this exhibit moving pictures showed the steps in the manufacture of "White Mazda" lamps and souvenirs made of "White Mazda" glass are manufactured and given away.

Westinghouse Lamp Co. showed the method of inspection and packing of lamps and by means of colored slides illustrated other steps in the manufacture of its products.

Industrial, store, office and residential lighting units of many different designs are exhibited by various manufacturers.

A large number of householders are attending the show and they find attraction in the many exhibits of electrical washing and ironing machines, vacuum cleaners, ranges and other electrical heating and cooking utensils. Among the electric baking ovens being

Exhibit of Modern Industrial Lighting Units and Show Window Lighting at Chicago Electrical Show.

shown is an automatically operated oven made by the Westinghouse Electric & Manufacturing Co. A combination kitchen sink and electric dishwasher is exhibited by the Dunn Manufacturing Co., and the Edison Electric Appliance Co. is showing its new automatic electric range.

A constant-current welding machine with 200 amperes capacity forms part of the General Electric Co. exhibit, which also includes industrial heating devices, ar acid-resisting insulated motor, wiring devices, etc.

Electric furnaces and samples of their products are exhibited by the Booth-Hall Co. and the Detroit Electric Furnace Co. One type of furnace is built upon the rocker principle while the other is of the revolving type.

The part that asbestos plays in the electrical industry is shown by the H. W. Johns-Manville Co. exhibit, which also includes enclosed switches, fuses, cutout bases, etc.

An exhibit by the Chicago Telephone Co. contains equipment to illustrate the procedure and operation of completing a telephone call. Sections of "A" and "B" boards are used to demonstrate the method of putting through a call in the exchanges.

The electrical contractors of Chicago are represented at the show with an exhibit conducted by the Electrical Contractors' Association of Chicago. Pictures of various installations form the background of the booth, and two electrically lighted miniature houses make an interesting exhibit that draws many prospective house-wiring customers.

Attendance at the show was stimulated by the Commonwealth Edison Co., which gave coupons with its electric light bills, entitling the holders to half-rate admission. The first week the attendance was larger than was expected and demonstrators are kept busy afternoon and evening showing the many time and labor-saving electrical devices at the show.

List of Exhibitors and Their Exhibits

Altofer Bros. Co., Peoria, Ill.—Electric washing machines.

Ackerman-Johnson Co., Chicago—Screw expansion bolts.

C. F. Adams Co., Chicago—Electric washing machines.

Apex Appliance Co., Chicago—Electric washing machines.

American Ironing Machine Co., Chicago—Electric ironing machines.

American Steel & Wire Co., Chicago—Steel and wire.

Americolite Co., New York, N. Y.—Electric lighting fixtures.

American Enameled Magnet Wire Co., Muskegon, Mich.—Magnet wire.

Anderson Electric Specialty Co., Chicago—Portable automobile headlights and specialties.

Amalgamated Machinery Corporation, Chicago—Automatic heaters.

M. B. Austin & Co., Chicago—Electrical jobbing specialties.

Art Metal Manufacturing Co., Chicago—Industrial and residential lighting fixtures.

Bake-Rite Corp., Chicago—Electric baking ovens.

Benjamin Electric Manufacturing Co., Chicago—Industrial reflectors and wiring specialties.

Bennage Co.—Electric glue pots, soldering irons, etc.

Bleadon-Dunn Co., Chicago—Electric therapeutic apparatus.

Blue Bird Appliance Co., St. Louis, Mo.—Electric washing machines.

Booth-Hall Co., Chicago—Electric furnaces.

Frank S. Betz Co., Hammond, Ind.—Electric therapeutic devices.

Central Electric Co., Chicago—Industrial reflectors, electrical supplies and auto accessories.

Central Station Institute, Chicago—Students' electrical courses.

Chicago Reedware Manufacturing Co., Chicago—Electric lamps.

Chicago Telephone Co., Chicago—General exhibit showing operation of telephone service.

Chicago Washing Machine Co., Chicago—Electric washing machines.

Clements Manufacturing Co., Chicago—"Cadillac" electric vacuum cleaners.

Commonwealth Edison Co., Chicago—General exhibit of central-station service; industrial, store, office and residential lighting, household appliances, etc.

Coyne Trade and Engineering Schools—Electrical engineering schools.

Commercial Lighting Co., Chicago—Electric lighting fixtures.

Contra-Pole Electric Co., Brooklyn, N. Y.—Electrotherapeutic apparatus.

Crane Co., Chicago—Electric power-plant supplies.

Crouse-Hinds Co., Syracuse, N. Y.—Electric switches and safety devices.

Cutler-Hammer Manufacturing Co., Milwaukee, Wis.—Electric switches, lifting magnets, wiring and heating devices.

George Cutter Co., South Bend, Ind.—Industrial and street-lighting specialties, switches and panelboards.

Frank B. Cook Co., Chicago—Electric soldering irons and specialties.

A. J. Deer Manufacturing Co.—Electric grinders and choppers.

Detroit Electric Furnace Co., Detroit, Mich.—Electric furnaces.

Delta-Star Electric Co., Chicago—High-tension electric distribution specialties.

De Mooy Electric Co.—Electrotherapeutic apparatus.

Dunn Manufacturing Co., Chicago—Electric dishwashing machines.

Duparquet-Huot & Moneusse Co., Chicago—Electric ranges and hotel equipment.

Eden Appliance Co., Chicago—Electric laundry machines and vacuum cleaners.

Edison Electric Appliance Co., Chicago—Electric heating appliances.

Edison Storage Battery Co., Orange, N. J.—Storage batteries and accessories.

Electric Appliance Co., Chicago—Electric jobbing supplies.

Electrical Record, New York, N. Y.—Electrical publications.

Electrical Journal, Pittsburgh, Pa.—Electrical publications.

Electrical Review, Chicago—Electrical publications.

Endless-graph Manufacturing Co., Chicago—Combination electric lamp and phonograph.

Eureka Vacuum Cleaner Co., Detroit, Mich.—Electric vacuum cleaners.

Estate Stove Co., Hamilton, Ohio—Electric ranges.

Electric Club of Chicago—General exhibit.

Electro-Magnetic Tool Co., Chicago—Electric hammers and drills.

Electric Storage Battery Co., Philadelphia, Pa.—Storage batteries and accessories.

Electro Steam Radiator Co., Chicago—Electric steam radiators.

Edison Lamp Works of General Electric Co., Harrison, N. J.—Mazda lamps.

Electric Service Construction Co., Chicago—Jobbers and contractors.

Electric Vacuum Cleaner Co., Cleveland, Ohio—Electric vacuum cleaners.

Electrical Contractors Association, Chicago—General exhibit of installations.

Electrical Testing Laboratories, New York, N. Y.—Exhibit of tested materials.

Elwell-Parker Electric Co., Cleveland, Ohio—Electric industrial trucks.

French Battery & Carbon Co., Madison, Wis.—Dry battery specialties, flashlights, etc.

Federal Sign System (Electric), Chicago—Electric signs, washing machines, vacuum cleaners, fuses, etc.

General Electric Co., Schenectady, N. Y.—Industrial heating devices, motors, street-lighting equipment, wiring devices, etc.

Grether Fire Equipment Co., Dayton, Ohio—Reflectors and flood-lighting equipment.

Habirshaw Electric Cable Co., New York—Electric wires and cables.

Hamilton-Beach Manufacturing Co., Racine, Wis.—Sewing machine motors, vibrators, vacuum cleaners, etc.

Handel Co., Chicago—Electric Lamps.

Hoover Suction Sweeper Co., North Canton, Ohio—Electric suction sweepers.

Hurley Machine Co., Chicago—Electric washing machines, ironing machines and vacuum cleaners.

Hot-Flo Faucet Corp., New York, N. Y.—Electric water-heating devices.

Hotwat Distributing Co., Chicago—Electric water-heating devices.

Ilg Electric Ventilating Co., Chicago—Electric ventilators.

Illinois Electric Co., Chicago—Electric jobbing supplies.

Inland Electric Co., Chicago—Electric jobbing supplies.

Judd Laundry Machinery Co., Chicago—Electric washing and ironing machines.

H. W. Johns-Manville Co., New York—Fuses, asbestos products, fire extinguishers, molded insulation, fibre conduit, etc.

Kellrohe Co., Chicago—Electric ironing machines.

Keeps-Fresh Electric Bakeries, Chicago—Electric ovens.

K. W. Battery Co., Chicago—Electrical storage batteries.

King Manufacturing Co., St. Joseph, Mo.—Electric street-lighting equipment.

Landers, Frary & Clark, New Britain, Conn.—Heating and cooking appliances.

Lindstrom, Smith Co., Chicago—Electric vibrators, heating devices, etc.

Lu-mi-nus Sign Letters Co., Chicago—Electric signs.

Manhattan Electric Supply Co., Chicago—Electric jobbing supplies.

Manufacturers Distributing Co., St. Louis.—Electric washing machines.

Majestic Electric Development Co., Philadelphia—Electric heating devices.

McClellan Refrigerating Co., Chicago—Electric refrigerating machinery.

Meyer, W. F.—Electric tools.

McGraw-Hill Co., New York—Electrical publications.

Edward Miller & Co., Meriden, Conn.—Electric lamps.

National Lamp Works of General Electric Co., Cleveland, Ohio—Incandescent lamps.

National X-Ray Reflector Co., Chicago—Reflectors, floodlights, etc.

New Home Sewing Machines Co.—Electric sewing machines.

Irwin Manufacturing Co.—Electric washing machines for metal parts.

Henry Newgard Co., Chicago—Electric contractor.

1900 Washer Co., Binghamton, N. Y.—Electric washing machines.

Oneida Truck Co.—Electric trucks.

Pathe Freres Phonograph Co.—Electric phonographs.

Pittsburgh Reflector & Illuminating Co., Pittsburgh, Pa.—Industrial lighting specialties.

Pneuvac Co., Worcester, Mass.—Electric vacuum cleaners.

Public Service Co. of Northern Illinois—Central-station service.

Regina Co., New York—Electric vacuum cleaners.

Reynolds Electric Co., Chicago—Electric sign flashers.

Roth Bros., Chicago—Electric motors.

Rutenber Electric Co., Marion, Ind.—Electric ranges and heating devices.

Remmert Co., Belleville, Ill.—Electric washing machines.

Shelton Electric Co., Philadelphia—Electric vibrators and specialties.

Simplex Electric Heating Co., Cambridge, Mass.—Electric heating and cooking devices.

Signal Corps, U. S. Army—Electric wireless signalling.

Standard Stamping Co., Huntington, W. Va.—Electric washing machines.

Surf Manufacturing Co., Milwaukee, Wis.—Electric washing machines.

Thomson Electric Welding Co., Lynn, Mass.—Electric welding machinery.

Thordarson Electric Manufacturing Co., Chicago—Electric X-ray apparatus, transformers, etc.

Torrington Co., Torrington, Conn.—Electric vacuum cleaners.

United Electric Co., Canton, Ohio—Electric vacuum cleaners.

Universal Electric Washer Co.—Electric washing machines.

Universal Products Co.—Farm-lighting plant.

J. W. Vaughn—Electric meat cutters.

Walker Vehicle Co., Chicago—Electric trucks.

Weeks Manufacturing Co.—Electric sterilizers.

Western Electric Co., Chicago—Electric cooking, heating and cleaning devices, sewing machines, etc.; printing telegraph, wireless telephone.

Wadsworth Electric Manufacturing Co., Covington, Ky.—Switches and wiring devices.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.—Electric heaters, motors, household appliances, etc.

Yankee System of Baking, Chicago—Electric ovens.

Central-Station Rates in Theory and Practice

Fifteenth Article—Defects of the Straight Meter Rate—Why Large Consumers Deserve Lower Rates — Various Forms of Step Meter Rates — Detailed Study of the Step Meter Rate

By H. E. EISENMENGER

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This is the fifteenth article of this series, which began in the issue of July 12. The first seven articles, forming Part I, treated of the cost of electric service. Part II included six articles on the policy to be followed in selecting a rate system. Part III begun last week will consist of six articles on the various rate systems in use. Parts IV to VI will discuss rate analysis, accuracy of rates and rate regulation by commissions. The articles will continue weekly until the close of this volume, Dec. 27.

PART III—SYSTEMS OF CHARGING—Continued.

II. The Various Types of Rates—(Continued).

B. Rates Based on Energy Consumption Only.

2. *Application of Lower Average Kilowatt-Hour Charges to Larger Energy Consumers.*

a. Reasons for the Desirability of a Graduation of the Kilowatt-Hour Charges.

SECTION 114. The defect of the straight meter rate—apart from the defects which it shares with all other rates based on the energy consumption only—is that it makes the large consumer pay the same unit price as the small one. The adequate prices per kilowatt-hour under a pure meter rate are far from being the same for all consumers. They become steadily lower as the energy consumption of the customer becomes larger and larger. There are a number of reasons for this which will be explained in the following.[1]

115. Wherever business transactions are made, it is an established principle that the wholesale buyer gets lower prices than the small consumer. Very few exceptions can be found from this sound business principle. As far as the electricity supply business is concerned, it is clear (from what has been said in Part I about the cost of electric service) that large consumers cause smaller unit cost and inasmuch as the cost is at least one of the factors that make up the price, we are justified in expecting to find lower unit prices for larger consumers in the electricity supply business.

The "customer cost" which is the same for all customers, as we have seen, makes the average cost per kilowatt-hour higher if a small consumer is being served than if the consumer is a large one. These differences in cost can be very considerable. Let us assume, for instance, that the customer cost to the central station be 60 cents per customer per month and that all the rest of the total cost to the central station (demand cost and energy cost together) be 3 cents per kilowatt-hour.[2] These values are in no way extremes and they can be said to be near average conditions. (The figures of the different central stations vary within wide limits.)

Now with these assumptions we can figure out the following table for the total average cost of customers with various energy consumptions:

Monthly Energy Consumption in kw-hr.	Average Cost to the Central Station in cents per kw-hr.	
5	$\frac{60 + (3 \times 5)}{5} = 15$	cents per kw-hr.
10	$\frac{60 + (3 \times 10)}{10} = 9$	cents per kw-hr.
20	$\frac{60 + (3 \times 20)}{20} = 6$	cents per kw-hr.
100	$\frac{60 + (3 \times 100)}{100} = 3.6$	cents per kw-hr
1000	$\frac{60 + (3 \times 1000)}{1000} = 3.06$	cents per kw-hr.
10000	$\frac{60 + (3 \times 10000)}{10000} = 3.006$	cents per kw-hr.

We see from this that the average cost per kilowatt-hour falls, first rapidly, with increasing energy consumption, and then more slowly, until for very large energy consumptions it becomes practically constant and converges towards the limit of 3 cents per kilowatt-hour.

Another reason why the average cost of the kilowatt-hour becomes lower as the energy consumption of the consumer increases is that the large consumer generally has a better load-factor, or a better diversity-factor, or both. A consumer, for instance, who is using only 10 to 20 kw-hr. per month is generally a residential customer or a small store owner, and this

[1] Graphical methods convey the best and most accurate conception of these several reasons and their effects. Drawings have been termed "the engineer's language" and it has been the author's experience that many commercial men get shy when it comes to representation of facts by curves. According to the leading principle of these articles to make their contents accessible as far as this can be done, to those who do not take kindly to mathematics and graphical representation, an attempt will be made in the following to explain purely by words the question why and how the unit price varies with the amount of the energy consumed, but the same question is treated graphically and much more thoroughly in Insert X. Readers who entertain no objections against curves are strongly advised to substitute Insert X for Sections 115-117. Later in the articles graphical and elementary mathematical methods will be found indispensable.

[2] From what has been explained before (Part I) it is not quite logical to divide the demand cost by the number of kilowatt-hours. The result of the operation is an average value which applies only under the given load-factor conditions. But as long as we deal with rates which do not take any cognizance of the maximum demand of the customer, we must of necessity be satisfied with this rough average, inaccurate as it may be. This is a disadvantage intrinsic to all rates which are based on the energy consumption only.

type of user is, as a rule, a short-hour user. If the kilowatt-hour consumption is a little larger, that is if it approaches the first 50 or 100 kw-hr. per month, we will in some cases still have a residential customer or a store owner, but a larger one. People living in larger residences are more liable to use current-consuming appliances other than lamps, such as flatirons, toasters, heating and cooking apparatus, and the like. Now these appliances generally have a much greater capacity than the ordinary lamp; a flatiron, for instance, is using 300 to 500 watts, or roughly as much as ten lamps. These appliances are largely used during the daylight hours and consequently they bring about an improvement of the customer's load-factor and with that of the central station's load-factor. Medium-sized stores are liable to use all-day lights in the back part of the establishment, also ceiling fans, desk fans, etc., which has a tendency to improve the customer's load-factor. If we now proceed to customers using several hundreds or thousands of kilowatt-hours per month, this increase in energy consumption is due generally not only to an increase in the size of the installation but also to the increase in the number of hours of daily use. If we go into a hotel, or a restaurant, or a large store, a theater, an office building, etc., we will always find a number of lamps burning in daytime, not a few of them may be even burning 24 hours a day; for instance, in the lobby and other portions of a hotel. Such large establishments will frequently also have some motors connected to the lines, for elevators, ventilators, refrigerators, and the like. All this means that large lighting consumers will have a better effect on the central-station load-factor than small ones. The same applies to power consumers, only for different reasons. A little workshop with not more than one or two machines consuming electric power will at some times during the day run at full load and at others at no load. The variation between the maximum and the minimum load will be 100%. If we have 100 motor-driven machines there will be a certain diversity between their power demands, just as we have seen a diversity between the power demands of different consumers. Every single one of the hundred machines may vary between full load and no load, but the more machines we have, the larger is the probability that at the time when one machine is running at full load another will have very little or no load so that the peaks and valleys of the various machine's load compensate each other and the load curve of the total establishment will be flattened out and become the smoother the larger the number of the power-consuming machines is; that is, in general the larger the energy consumption of the consumer is.

116. The above refers to the cost. If we were to add the same percentage for profit in every case (cost-of-service principle, see Part II) obviously the same relations would subsist between the prices charged to various customers as have been found between the cost of these customers. The value-of-service principle requires, however (see Part II), different percentages of profit for different customers and we shall now investigate in what manner the relations between prices for various sizes of customers will differ from the relations between costs of the same customers.

It has been shown in the discussion of the value-of-service principle (Sections 97-99) that the percentage of profit from the largest and from the smallest customers should be smaller than that from the medium-sized ones. This furnishes another reason why the consumers with a large energy consumption should receive lower unit prices per kilowatt-hour. But at the same time the value-of-service principle seems to point towards giving lower prices to the small consumers also and this in opposition to what we have found so far about what the cost of the small customer is. The tendency of the value-of-service principle to lower the price per kilowatt-hour to the smallest consumers doubtless exists, but in case of the straight meter rate it is more than offset by the influence of the fixed customer cost which has just been explained. We see, for instance, in the table of Section 115 that the change of the average cost per kilowatt-hour which is due to the influence of the customer cost is much more marked in the region of the smallest consumers than in that of the medium and large consumers. It vanishes the more the larger the consumers become. If we assume, for the sake of an example, the typical small consumer to be one of 20 kw-hr. and the typical medium-sized consumer to be one of 200 kw-hr. monthly consumption, the average cost per kilowatt-hour of the small customer would be 6 cents per kw-hr. and that of the medium one 3.3 cents per kw-hr. The cost to the central station of the typical small consumer is then nearly twice as high, if referred to the kilowatt-hour, as that of the medium-sized one and even if we add a very much lower percentage of profit for the small consumer in obedience to the value-of-service principle, the price charged to him per kilowatt-hour will still be higher than for the medium-sized consumer.

117. Summarizing, we can say: Where the customers are classified by their kilowatt-hour consumption only, the unit kilowatt-hour prices should decrease with the size of the consumer for the following three reasons:

1. The fixed customer cost is distributed over a larger number of kilowatt-hours.

2. The load-factor is liable to be better for large energy consumers than for small ones.

3. The percentage of profit is to be reduced for both the largest and the smallest consumers according to the value-of-service principle. This works towards further lowering of the prices of very large consumers. As regards the smallest consumers this effect is more than offset by item 1.

Several attempts have been made to follow this principle in the meter rates, that is to correct the straight meter rate in such a manner that the larger energy consumer gets lower average prices per kilowatt-hour. These methods consist either of a restriction of a given straight meter rate to certain classes or sizes of customers or of a modification of the meter rate which results in the so-called *sliding-scale rate* or of the addition of an explicit customer charge. The term "sliding-scale rate" means meter rates which specify decreasing charges per kilowatt-hour as the energy consumption of the customer increases.

These methods will be discussed hereinafter.

b. The Methods for Applying Lower Average Kilowatt-hour Prices for Larger Energy Consumers.

1. Limited Application of the Straight Meter Rate.

118. Those central stations as are using a straight meter rate at all restrict it to certain classes of consumers, at least certainly all the large and medium-sized central stations. Some central stations have restricted the straight meter rate to small customers only, chiefly residential customers or "general lighting" customers. Others have several straight meter rate schedules, those with higher charges apply-

ing to such classes as are liable to consist of small energy users only, such as residence lighting, whereas the lower charges apply to such uses where the amount of energy consumed is greater or the load-factor is better, or both.[3]

2. The Step Meter Rate.

119. Another one of these methods is given by the step meter rate. The range of kilowatt-hours, beginning from zero, is divided into a certain number of "steps" and the unit price charged per kilowatt-hour depends upon the "step" which the customer's energy consumption has reached in that respective month. The higher the step which has been reached, the lower is the charge made per kilowatt-hour. In contradistinction to the "block rate" to be discussed hereafter, all kilowatt-hours consumed by a certain customer in a certain month are charged at the same price.[4]

A step meter rate can also be expressed in the form of a straight meter rate with "quantity discounts," that is, discounts which increase as the quantity consumed increases.[5]. The quantity discounts need not be given according to the number of kilowatt-hours. They can also depend on the amount of the bill.[6] In case of pure meter rates this is only another form of stating the same thing, but we will later see some of the rates where it does make a difference whether we apply the quantity discounts according to the number of kilowatt-hours or to the amount of the bill (see Section 168).

120. The plain step meter rate has a serious drawback and that is the possibility of a reduction of the bill by an increase of the consumption.[7] The man who is careful about his bill and understands the rate may under certain circumstances reduce his bill by wisely wasting energy shortly before the meter reader comes around. He can thus not only make the company furnish gratuitously the wasted energy, but he can reduce the company's revenue from him besides.[8]

This sudden reduction in the income of the company from the consumer is smaller and less important if the difference of the prices per kilowatt-hour between neighboring steps is smaller. If, therefore, we wish to design a schedule with a given unit price in the first step (maximum price) and another given unit price in the last step (minimum price) it follows that the difference between these two prices should be split up and divided between a large number of intermediate steps if the effect of the above-mentioned undesirable feature shall be kept in narrow limits. We find for this reason that step rates in practice frequently have a large number of steps.[9]

Another method for getting around the drawback mentioned is to make a statement in the step-rate schedule to the effect that the total charge is never to be greater than what would be due (at the next lower rate, that is at the next higher step) for a greater consumption.[10]

This may also change the form in which the step rate is expressed, inasmuch as the upper end of a step must no longer coincide with the beginning of the next higher step (or remain within 1 kw-hr. below it). The whole range of energy consumption within which the charge is constant is then exempted from the steps, or counted as separate steps.[11]

121. A step meter rate with this stipulation can to a certain degree also be expressed as a system of optional straight meter rates, each one involving a

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[3] For example, Reading, Pa., charges 10 cents per kw-hr. for residence lighting and 3 cents per kw-hr. for cooking and heating. This is also based on the "value of service" principle (see Part II.) The Toledo rate discussed before (Section 99) that is, a straight meter rate varying with the guaranteed minimum in such a manner that the higher the guarantee the lower the kilowatt-hour charge, belongs also in this class.

[4] The example of the General Lighting schedule at Allentown, Pa., will illustrate this rate. Under this schedule the charge per kilowatt-hour is as follows:

10 cents, if the customer's monthly energy consumption is 100 kw-hr. or less.
9 cents, if the customer's monthly energy consumption is between 101 and 200 kw-hr.
8 cents, if the customer's monthly energy consumption is between 201 and 400 kw-hr.
7 cents, if the customer's monthly energy consumption is between 401 and 800 kw-hr.
6 cents, if the customer's monthly energy consumption is 801 kw-hr. and over.

[5] For instance, the Retail Power rate in Birmingham, Ala., is a straight-line meter rate of 7 cents per kw-hr. with the following quantity discounts applying on the total bill:

10% if the energy consumption is 450 kw-hr. or less.
15% if the energy consumption is more than 450 kw-hr.

This means that the rate is 6.3 cents per kw-hr. if 450 kw-hr. or less are consumed and 5.95 cents per kw-hr. if more than 450 kw-hr. are consumed.

In the General Lighting rate of Mobile, Ala., which is a step meter rate, the prompt-payment discount is stepped off according to the energy consumption. The gross rates are:

10 cents per kw-hr. up to 50 kw-hr.
9 cents per kw-hr. from 51 to 150 kw-hr.
8 cents per kw-hr. from 151 to 300 kw-hr.
7 cents per kw-hr. from 301 to 500 kw-hr.
6.5 cents per kw-hr. over 500 kw-hr.

The prompt-payment discount is 3 cents per kw-hr. if the consumption is 1 to 50 kw-hr. and 2 cents per kw-hr. if the consumption is over 50 kw-hr.

The net amount per kilowatt-hour for the first step is therefore $10 - 3 = 7$ cents, and for the second step $9 - 2 = 7$ cents. The prompt-payment discount is therefore in this case graded in such a way as to entirely wipe out the difference between the first and the second step.

[6] General Lighting rate of Jacksonville, Fla. The following discounts are given on a straight meter rate of 7 cents per kw-hr.:

10% if the monthly bill is at least $50, 15% if the monthly bill is at least $100, 20% if the monthly bill is at least $150; 25% if the monthly bill is at least $200; 40% if the monthly bill is at least $300.

This is, of course, the same as if we were to say: The rate is a step rate charging (net)

7 cents per kw-hr. for 1 to 5000/7 or 1 to 714 kw-hr.
6.3 cents per kw-hr. for 715 to 10 000/7 or 715 to 1428 kw-hr.
5.95 cents per kw-hr. for 1429 to 15,000/7 or 1429 to 2142 kw-hr.
etc.

[7] A customer, for instance with a consumption of 200 kw-hr., in the above Allentown schedule, will have to pay $200 \times 9 = 1800$ cents or $18. If now he increases his energy consumption by one kilowatt-hour, that is to 201 kw-hr., he will have to pay $201 \times 8 = 1608$ cents or $16.08.

[8] This is clearly shown in a graphic representation of the step rate. We again step off the energy consumption horizontally in kw-hr. as abscissae and plot the amount of the corresponding monthly bills vertically as ordinates (Fig. 5). The line representing the 10-cent-per-kw-hr. rate (for the above Allentown schedule, footnote 4, Section 119) is found by joining the origin O with a point given, for instance, by the abscissa 500 kw-hr. and the corresponding ordinate $500 \times 10 = 5000$ cents or $50 (point A_{10}). This inclined straight line represents a straight

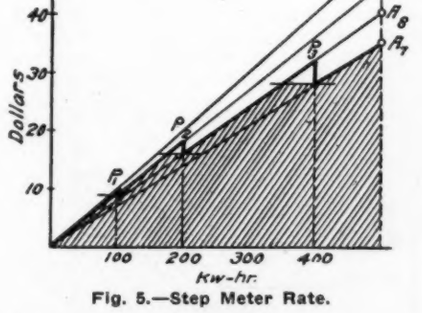

Fig. 5.—Step Meter Rate.

10-cent-per-kw-hr. rate and applies as far as the 10-cent rate applies, that is from 0 to 100 kw-hrs. From there on (point P_1) the 9-cent rate applies, which is represented by another straight line drawn from the origin under a correspondingly smaller angle to point A_9 (500 kw-hr., $45). The figure shows clearly the resulting peak at P_1 which indicates how the bill suddenly drops as soon as we exceed the 100-kw-hr. mark; 100 kw-hr. are billed at $10 and 101 kw-hr. at $9.09. The same condition is repeated with the transcending of every one of the other steps (points P_2, P_3, etc., heavy outline).

[9] The Optional Power rate schedule of Newark, N. J., has as many as 42 steps. The Retail Power rate of Wilmington, Del., has 24 steps, and many schedules have a dozen steps or so.

[10] The Retail Power schedule of Albany, N. Y., is an example of a step meter rate with this stipulation.

The effect of this stipulation represented graphically is the cutting off of the sawtooth-like peaks of the charge curve by horizontal lines. (Compare the shaded area in Fig. 5.)

minimum guarantee of its own in such a way that the rates with the higher kw-hr. charges require lower guarantees and vice versa. (Compare the example in footnote 10 of Section 108.) This represents a step meter rate of the described variety, *provided* the customer chooses that one of the optional rates which results in the lowest total payment for his energy consumption. The customer may therefore have to pay more than under the equivalent step meter rate, but he can never be charged less.[12]

If a step rate contains the stipulation that the charges are never to be higher for a smaller energy consumption than for a larger one—no matter in which one of the above forms the stipulation is made—the customer can no longer decrease his bill by judiciously increasing his energy consumption. But he can increase his consumption in a considerable range without being charged for the increase. The drawback of the rate is mitigated, but not removed.

For some remarks on the theory of the step rate see also Insert XI.

[11] For instance, the General Lighting schedule of Lynn, Mass., charges:

10 cents per kw-hr. (net) for 1 to 228 kw-hr.
8 cents per kw-hr. (net) for 285 to 1800 kw-hr.
6 cents per kw-hr. (net) for 2400 and over.

No bill is made out larger than what would be obtained for a greater consumption at a lower rate.

It will be seen that 228 kw-hr. at 10 cents per kw-hr. cost the same as 285 kw-hr. at 8 cents per kw-hr., etc.

The step meter part of the General Lighting and Power schedule of Washington, D. C., is worded after the following fashion:

6 cents per kw-hr. for the first 3200 kw-hr.
$192 for 3200 to 3500 kw-hr.
5.5 cents per kw-hr. from 3500 to 4545 kw-hr.
$250 for 4545 to 5000 kw-hr.
5 cents per kw-hr. from 5000 to 7500 kw-hr.
$375 for 7500 to 8333 kw-hr.
etc.....

This is obviously only another way of expressing the above stipulation.

[12] The Off-Peak Emergency Lighting and Power schedule of Des Moines, Iowa, for instance, provides the following optional rates:

3.1 cents per kw-hr. with guarantee 4,500 kw-hr. (that is $139.50)
2.9 cents per kw-hr. with guarantee 6,000 kw-hr. (that is $174.00)
2.7 cents per kw-hr. with guarantee 8,000 kw-hr. (that is $216.00)
2.4 cents per kw-hr. with guarantee 10,500 kw-hr. (that is $252.00)
2.2 cents per kw-hr. with guarantee 14,000 kw-hr. (that is $308.00)
2.0 cents per kw-hr. with guarantee 18,000 kw-hr. (that is $360.00)
etc.

This is evidently the same as the following step meter rate with a minimum charge of $139.50 (as above):

3.1 cents per kw-hr. for less than 6000 kw-hr.
2.9 cents per kw-hr. for 6000 to 8000 kw-hr.
2.7 cents per kw-hr. for 8000 to 10,500 kw-hr.
etc.

with the provision that no charge shall be higher for a lower number of kilowatt-hours than for a higher one. (See Fig 6.)

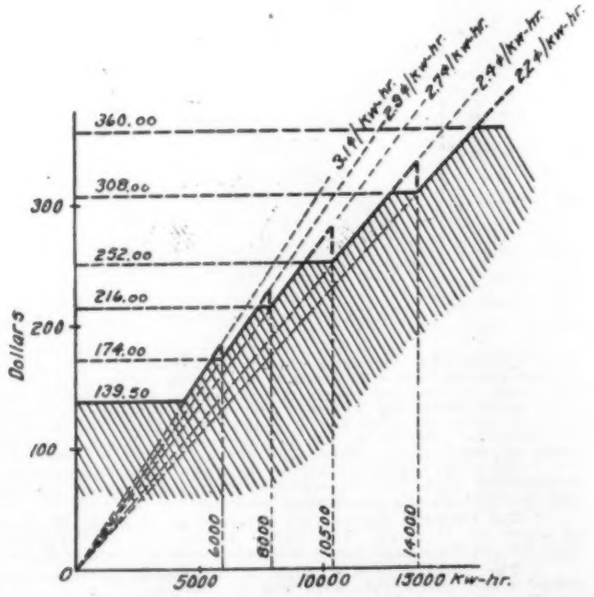

Fig. 6.—Identity of Step Rate and Variable Meter Rate in Combination with Variable Minimum Charge.

Insert X—Appendix to Section 114.

REASONS FOR THE DESIRABILITY OF GRADUATION OF THE ENERGY CHARGES WITH PURE METER RATES.

(*Graphic Interpretation.*)

The problem of how and why the energy charge of a pure meter rate should vary with the energy consumption is much more readily interpreted by the curve which shows the total charges (customer's bill) as a function of the energy consumption than by the customary curve of the average charges per kilowatt-hour and the former curve gives a much better and more direct insight into the problem than the latter. It is easy to reduce the curve of the total charges to the curve of the average charges per kw-hr. (see Insert XIV) should this be desired, but it is not at all necessary. The total bill is really the primary function of the energy consumption and the average charge per kw-hr. is a secondary function, being

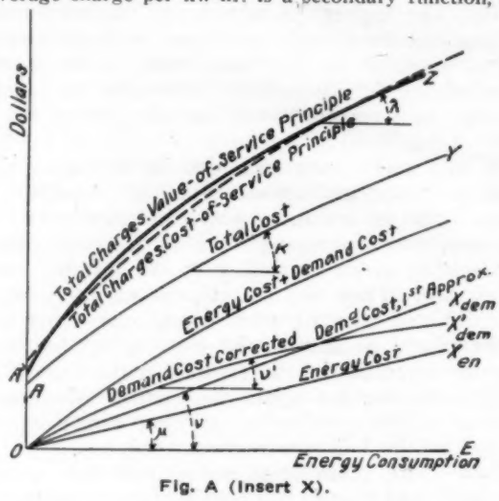

Fig. A (Insert X).

the total bill divided by the energy consumption. (The only exception to this is the straight meter rate where both functions may be considered to be of equal importance.)

As regards the shape of the curve of total charges, we have to remember that the total charge, i. e. the bill, is composed of cost plus profit.

The cost, as has been shown in Part I, is composed of the energy cost, the demand cost, and the customer cost.

The energy cost is proportional to the energy consumption and the curve representing this part of the cost with relation to the consumption is therefore a straight line OX_{en} (Fig. A) rising from the origin O of co-ordinates.[1]

As we are dealing at present with such rates only as do not contain any demand charge, we will have to base the entire cost of calculation on the kw-hr. as unit, that is, we will have to average the demand cost in some manner between the kilowatt-hours consumed. Assuming as an approximation that all customers have the same demand for every kilowatt-hour consumed (in other words, the same load-factor) the demand cost will also be defined by a straight line rising from the origin, OX_{dem} in Fig. A. The size of the angle ν at which it rises, depends upon the average load-factor; a large load-factor results in a small angle and vice versa. Now it has been explained (Section 115 of the main text) that large energy users on the average have a larger load-factor than small ones. Therefore the demand cost is not strictly proportional to the amount of energy consumed, but it increases less and less rapidly as we proceed on the curve from the small energy consumers to the medium and large ones. The demand cost will rise more rapidly for the small energy consumers than indicated by the straight line OX_{dem} and less and less rapidly as we proceed to the medium and large ones. The straight line OX_{dem} will therefore have to be corrected to a shape[2] of the type OX'_{dem}, steadily curving downwards.

Adding the ordinates OX_{en} and OX'_{dem} for every abscissa and adding further the constant customer cost as given by OA results in the curve AY as the curve of the total cost.

[1] The angle of elevation μ is obviously the larger, the higher the energy cost per kilowatt-hour is (kw-hr. cost per kw-hr.). Those of our readers who are familiar with elementary mathematics will understand that tan μ is proportional to the kilowatt-hour cost per kilowatt-hour.

[2] The angle of elevation ν of OX'_{dem} towards the horizontal becomes steadily smaller as the energy consumption increases and it converges towards a certain minimum ν'_{lim}, that means, although it always remains larger than that minimum, it approaches that minimum value steadily more and more the larger the energy consumption becomes.

For the energy consumption 0 this curve indicates a certain minimum value of cost—equal to the customer cost OA. The curve rises from the point A and the angle of elevation χ becomes smaller and smaller as the energy consumption increases.[3]

From the curve of the cost we arrive at the curve of the price (charges or total bill) by adding the profit as a certain percentage of the cost. Now it has been shown (Sections 97-99) that the value-of-service principle requires this percentage to be smaller at either end of the curve (that is, for the large and for the small consumers) than in the middle (medium-sized consumers). A constant percentage of profit added would result in the dotted curve[4] for the total charges (bills), whereas these charges under the value-of-service principle would be typified by the heavy line A'Z'.[5]

Insert XI—Appendix to Section 121.

THEORETICAL REMARKS ABOUT THE STEP RATE—INACCURACY—SIZE OF THE STEPS—SIZE OF THE ENERGY CHABGES DESIGN OF A STEP RATE.

The sudden reductions of the bill which take place with the step rate when the limit between two steps is exceeded, bring it about that, as we gradually proceed from the lower to the larger energy consumption, the bills are alternately larger and smaller than they ought to be. The same is indicated by the zigzag form of the curve (Fig. 5 of the main text and Figs. A to C of this Insert) which gives the actual amount of the bill (stepped off in vertical direction) for the

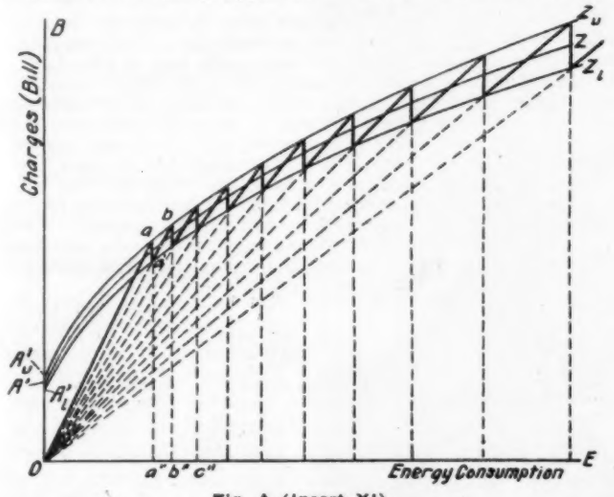

Fig. A (Insert XI).

varying energy consumptions (stepped off horizontally). This zigzag form which brings the curve of the actual bill alternately above and below the curve which shows what the bill ought to be theoretically (see the preceding Insert X) persists even if we stipulate that the bill shall never be greater than what would be billed for any larger energy consumption (Figs. D and E).

It seems logical to require that these periodic positive and negative deviations or inaccuracies should by a proper choice of the rate constants be limited to a certain percentage of the total bill in such a manner that at each and every cycle—that is, at each step of the schedule—the inaccuracy just touches this maximum percentage on the positive and on the negative side.

Supposing, for illustration, that we have given the curve of total charges $A'Z$ as we want them to be (see Fig. A) and assuming further the permissible percentage of inaccuracy at $\pm 5\%$, we draw one curve A'_uZ_u, the ordinates of which are 5% greater than those of the given charge curve $A'Z$ (Fig. A) and another curve A'_lZ_l with ordinates 5%

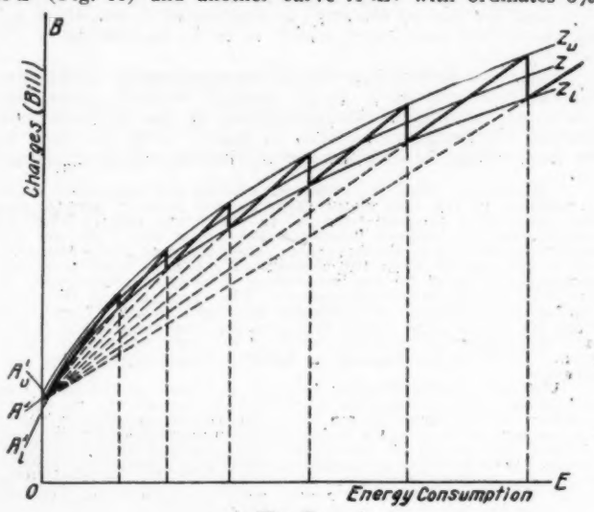

Fig. B.

smaller. Starting with a certain initial straight meter rate given by Oa, we drop a vertical line from the intersection point of that line with the A'_uZ_u curve. This vertical intersects the curve A'_lZ_l at a'; $a''a'$ is now practically 10% smaller than $a''a$. Connecting a' with O gives us the second step of the step rate $Oa'b$, etc.

The drawing Fig. A shows that with the typical shape of the curve of charges $A'Z$ the increments of the steps $a''b''$, $b''c''$, etc., become steadily greater and greater as we advance into the higher steps.

This does not apply, however, to the first step Oa'', as can be seen from Fig. A. Counting *backwards* from the larger energy consumptions to the smaller ones, we see that, in order to satisfy the requirement of a constant percentage change of the bill between steps, the steps would have to become smaller and smaller and finally to become infinitely small. In other words, we would never reach a first step. Therefore, the first step must of necessity exceed the limit of the given percentage of inacuracy, inasmuch as in the lower portions of that step the amount of the bill will be much smaller than permitted by that requirement. (For the energy consumption 0 the percentage inaccuracy will even become infinitely large, since the amount of the bill is 0 whereas it ought to be equal to the customer charge OA'). The size of the first step is not governed by the same law as that of the other steps.[1]

As regards the unit charges per kilowatt-hour it is easy to show that under the above requirement of a constant percentage reduction of the bill between steps the unit charges must decrease in a geometrical relation, which means that the ratio of the kilowatt-hour charge in a given step to the kilowatt-hour charge in the preceding step is constant or, in other words, the kilowatt-hour charge in any step can be found

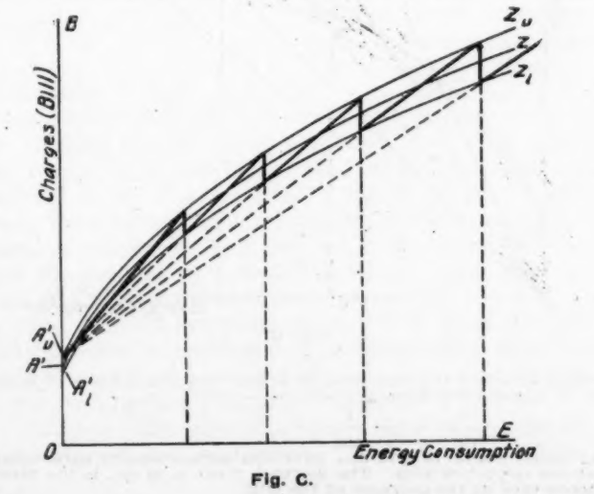

Fig. C.

[3] The angle of elevation K of the cost curve AY also converges towards a limiting value K_{lim} which is the larger the larger μ and the larger μ_{lim} is, $\tan K = \tan \mu + \tan \mu'$ and $\tan K_{lim} = \tan \mu + \tan \mu'_{lim}$.

[4] The angle of elevation λ is given by $\tan \lambda = (1 + p/100) \tan K$ if p is the constant percentage of profit added and it converges towards λ_{lim} where $\tan \lambda_{lim} = (1 + p/100) \tan K_{lim}$.

[5] The electric company is generally interested in an increase of a customer's consumption only as long as such an increase brings about an increase in the profit from that customer in dollars and cents. In accordance with the value-of-service principle the percentage may be reduced incidentally to the increase of the energy consumption, but if—roughly speaking—the reduction of that percentage goes so far that the amount of the profit in dollars and cents remains stationary—not to say decreases—the electric service company will refuse to be interested in such additional business. For that reason the $A'Z$ curve will in every part of its course be steeper than the corresponding part (that is, the part with the same abscissa) of the cost curve AY. In other words, the increment of charges will always have to be larger than the increment of cost.

from the kilowatt-hour charge in the preceding step by multiplying the latter by a given constant percentage.[2]

To summarize: *The gradation of the energy charges is given by the percentage drop of the bill permitted between steps and the size of the steps is determined by the shape of the theoretical rate curve which is to be approximated by the step rate.*

Since the percentage should be constant by which the kilowatt-hour charge is to be reduced between steps, the numerical amounts of the reductions of the kilowatt-hour charges (in cents or fractions of cents) from one step to the next should become smaller as the kilowatt-hour charge itself becomes smaller, that is as the number of kilowatt-hours becomes greater.

However, for obvious reasons simple figures are desirable for the unit charges (either gross or net, see Section 110), that is either whole cents or multiples of half or quarter cents, or decimal figures of cents with one or two digits. In the latter case the second decimal is preferably a figure 5. In consequence of these limitations we have to be satisfied with graduating the unit charges by identical intervals, for instance half cents, over a number of steps and then change to a graduation of, let us say, quarter cents for the next few steps, etc. This will, of course, have the effect that the balance between the percentage drops at the various step limits will be more or less disturbed.

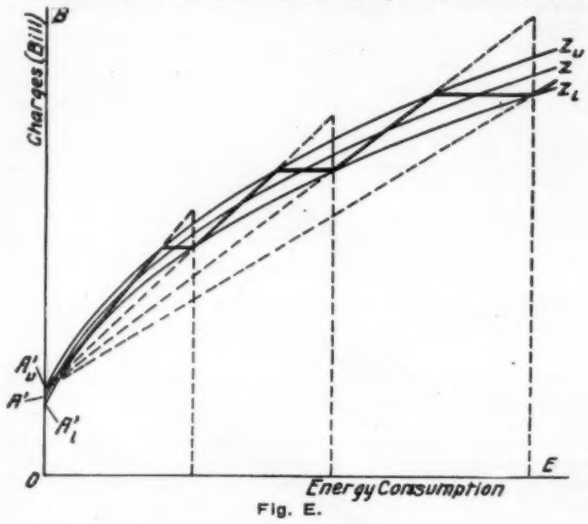

Fig. E.

The following table is an example, taken from practice, of a power step rate (1st and 2nd columns). The units of energy happen to be in this case horsepower-hours and not, as usual, kilowatt-hours. The third column gives the increment in the length of the respective step to the next following one, showing how these increments increase in size. The fourth and fifth columns show the decrements of the energy charges from the respective step to the next, in cents per horsepower-hour and per cent, respectively. In accordance with what has been said above, the percentage of the decrement of the unit energy charge is equal to the percentage decrement of the bill between the same two steps. The table shows that this percentage varies between the limits 5.55 and 10.34%. By strictly carrying out the principles outlined in this Insert, the percentage can be made never to exceed the limit of 9.09%[3] with the same number of steps and no finer gradation of the unit charges (multiples of 0.05 cent per hp-hr.). This is indicated in the three last columns of the table and is done by extending the 0.25 cent per hp-hr. and 0.15 cent per hp-hr. decrements of the unit charge a little further at the expense of the 0.2 cent per hp-hr. decrement.

1	2	3	4	5	6	7	8
			Interval to next energy charge.		Suggested improvement. Interval to next energy charge.		
Cents per hp-hr.	For hp-hrs.	In-tervals, hp-hrs.	c/hp-hr.	%	c/hp-hr.	c/hp-hr.	%
5	99 or less	...	0.5	10			
4.5	100 to 199	100	0.25	[1]5.55			
4.25....	200 to 399	200	0.25	5.88			
4	400 to 599	200	0.25	6.25			
3.75....	600 to 799	200	0.25	6.67			
3.5	800 to 1,199	400	0.2	5.71	3.5	0.25	7.14
3.3	1,200 to 1,599	400	0.2	6.06	3.25	0.25	7.69
3.1	1,600 to 2,399	800	0 2	6.45	3.00	0.25	8.33
2.9	2,400 to 3,599	1,200	0.2	6.90	2.75	0.25	9.09
2.7	3,600 to 4,799	1,200	0.2	7.41	2.50	0.2	8.00
2.5	4,800 to 5,999	1,200	0.2	8.00	2.30	0.2	8.70
2.3	6,000 to 7,999	2,000	0 2	8.70	2.10	0.15	7.04
2.1	8,000 to 9,999	2,000	0 2	9.52	1.95	0.15	7.69
1.9 10,000	to 11,999	2,000	0.15	7.90	1 80	0.15	8.33
1.75....12,000	to 14,999	3,000	0.15	8.57	1.65	0.15	9.09
1.6 15,000	to 19,999	5,000	0.15	9.37	1.50	0.1	6.67
1.45....20,000	to 29,999	10,000	0.15	[2]10.34	1.40	0.1	7.14
1.3 30,000	to 39,999	10,000	0.1	7.69			
1.2 40,000	to 59,999	20,000	0.1	8.33			
1.1 60,000	to 79,999	20,000	0.1	9.09			
1.0 80,000	and over						

[1]Minimum. [2]Maximum

(To be continued.)

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[1] Where we have the customer charge OA' explicitly made in addition to the step meter rate, we can draw a line for the first step as a tangent from A' to the lower curve (Fig. B) and where this tangent intersects the upper curve we get the point a as the end of the first step. Then the rate in its first step will never deviate from the theoretical value by more than the percentage allowed for the inaccuracy. The subsequent construction from Fig. B is self-explanatory. The increments of the steps will be larger than if the customer charge is absent. Larger increments of the steps result in a smaller number of steps necessary to cover a given total range of kilowatt-hours and consequently—*ceteris paribus*—in a greater simplicity of the rate schedule.

We can further slightly increase the size of the first step and of the step increments (and thereby reduce the necessary number of the steps) if we take the amount of the customer charge not at its correct value OA' but enhanced by the permissible percentage of inaccuracy, that is, if we take the customer charge at OA'_u. A comparison of Figs. B and C will explain this without further words. In practice this means that it is better for the simplicity of a step rate with a customer charge to choose the latter too large than too small.

A stipulation that the charges shall never be larger for a smaller energy consumption than for a larger one (Section 120) will also increase the size of the increments of the steps; consequently the number of steps which are necessary to cover a certain range of kilowatt-hours will become smaller. This is shown in Fig. D, which is also self-explanatory. Fig. E finally shows a combination of that stipulation with a customer charge and demonstrates plainly the reduction in the number of steps.

[2] To explain this, let us suppose, for instance, that we have a rate where some one of the steps charges 6 cents per kw-hr. up to 800 kw-hr. and that the drop of the bill between every two steps is required to be 5% of the bill. The drop will then be 5% of (6×800); that means the bill for 800 kw-hr. calculated with the charge of the next following step (to be quite exact we would have to say: the bill for 801 kw-hr.) must be 95% of (6×800). The charge per kilowatt-hour in this following step will then be $\frac{95\% \text{ of } (6 \times 800)}{800}$ or 95% of 6 cents, that is 5% less than the charge in the original step.

For readers who are familiar with algebra: Call S_n the number of kilowatt-hours at the end of the n^{th} step and p the percentage by which the bill is to be reduced when we exceed the limit of the $S_n{}^{th}$ kilowatt-hour, that is the limit between the n^{th} and the $(n+1)^{st}$ step. Let further c_n and c_{n+1} denote the kilowatt-hour charge in the n^{th} and $(n+1)^{st}$ step, respectively. The bill at the end of the n^{th} step is $c_n S_n$ and at the beginning of the $(n+1)^{st}$ step it is $c_{n+1} S_n$. (To be quite exact we would have to say $c_{n+1}(S_n + 1)$ but S_n is always very much greater than 1 so that we can set S_n for $S_n + 1$). We have thus

$$c_{n+1} S_n = c_n S_n (1 - p/100)$$

S_n cancels out, indicating that neither the number of kilowatt-hours at which the step limit is located nor the number of steps is of any consequence, and we get

$$\frac{c_{n+1}}{c_n} = 1 - \frac{p}{100}$$

in other words, c_n and c_{n+1} have the same ratio to each other as the respective bills. The decrease from c_n to c_{n+1} is the same percentage as the decrease of the bills.

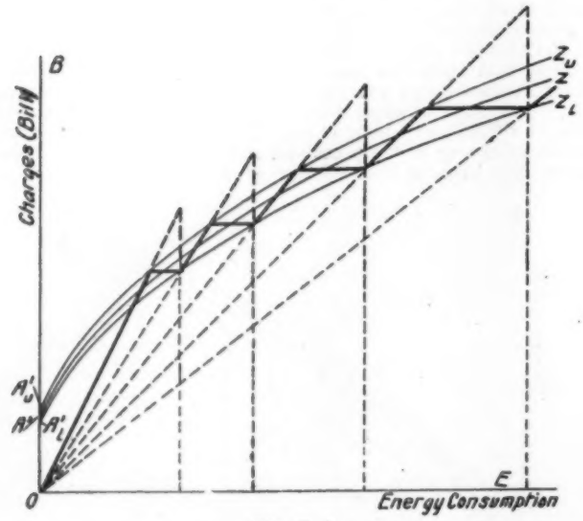


Fig. D.

[3] The first step is not counted for the reason given above.

What Electricity Has Done to Help Humanity

The Extremely Varied and Indispensable Services Performed by Electricity in the Great War—Value of Niagara Falls Hydroelectric Development—Direct and Indirect Aid in Winning the War

By J. C. McQUISTON

Manager, Department of Publicity, Westinghouse Electric & Manufacturing Co.

FROM the mouth of a great gun behind the Allies' trenches in France went a shell screaming into the enemy's territory. Dig into the history of that shell and you will find it charged with electricity. From the moment when this powerful little agent of democracy was finally sent upon its mission, back to its very beginning, its trail is crossed and recrossed at a thousand points by electric currents.

The guns that fired it, the motor truck that delivered it to the ammunition dump, the trains that brought it from the little French seaport to the trucks, the ships that carried it overseas, the tools that fashioned it, the metals and chemicals that went into its structure—touch the history of any of these factors in the production and progress of that shell, and you will feel the vibrating current of electricity.

And so with practically everything that entered into the waging and the winning of that terrible struggle.

"Ships will win the war," was the cry from many quarters. To almost every phase of ship construction and to ship operation you will find electricity made great contributions.

"Aeroplanes will win the war," came the word from many others. Without electricity we should have had no aeroplanes to help us win the fight.

"Food will win the war," was a popular shibboleth. What a story of electrical accomplishments is to be found in the story of food production.

What is there that man made or did for the cause of democracy and freedom over there or over here which did not, in some measure, depend upon the light, the heat or the power of electricity?

Consider in their broad divisions the various lines of activity that finally converged upon the great battleground. Agriculture, mining, lumbering, manufacture, transportation, communication—every one of these had reached its present stage of development with the immeasurable help of electricity.

J. C. McQuiston.

The hydroelectric power development at Niagara Falls is perhaps as good a single illustration as any that could be given of the essential part electricity played in winning the war. The cheap electricity produced at Niagara Falls made possible the founding of the artificial-abrasive industry in the United States, and with the natural supply of emery and corundum from Asia Minor cut out by the war, where should we have been without Niagara's artificial grindstones, whetstones, and other grinding implements of carborundum and the like? In every plant where alloy and tool steels were used, Niagara Falls' abrasives helped to win the war. In the munitions plants, in the locomotive works, in the automobile factories, in the foundries, in the machine shops, you will find it did indispensable tasks.

Was there anything more necessary for success in the war than an abundance of high-grade steel? And considering no other phase of electricity's extensive participation in the making of steel, what would we have done without ferro-silicon, another product which comes almost entirely from Niagara where cheap electric power made the commercial development of the ferro-silicon industry possible? As a purifier, ferro-silicon entered into the making of practically all our shell steel as well as steel for divers other purposes.

And there is ferro-chronium, which gives to steel that hardness so necessary in the production of shells and likewise in the making of tools and other steel—it, too, is largely a Niagara Falls product.

Niagara Falls electricity gives us a great part of our tungsten and vanadium. And of the various

alloys, what it does not help to produce directly, it contributes to indirectly through the production of aluminum. Think what a factor aluminum was in the winning of the war through its application to the motorcar, motortruck and aeroplane engine alone, and the electric power development at Niagara may truly be said to have made aluminum a commercial possibility.

It has been figured that between Niagara's alloys and abrasives every industry utilizing steel has multiplied its productive powers by three, and that if it had not been for these abrasives and alloys every motorcar factory in America could have reached but one-fifth of its war production.

Niagara's electricity gives us chlorine, one of the greatest life-saving agencies used in the war. For chlorine was one of the commonest and most effective disinfectants used in treating the wounded soldiers.

Niagara Falls' electricity gives us many of the materials from which picric acid and other explosives are made.

And all of this was but the contribution of a single electric power development.

To win the war food had to be produced in quantities sufficient not only to meet our own needs at home and the needs of our soldiers, but also in large part the requirements of our Allies. Electricity was a powerful agent in the maintaining and stimulating of food production.

The farmer fertilizes with chemicals obtained by electrical processes; he depends upon tools and machinery into the making of which electricity has already entered, and in many cases upon machinery, such as tractors, that requires electricity in operation.

In the converting of the farmer's wheat, corn, and oats into bread and cereal products, electricity plays a tremendous part. It helps to grind, to refine and to bake. It is an essential factor in the preparation and conservation of other foodstuffs, such as meat, fruit and vegetables, as a visit to a packing plant or any canning establishment will quickly demonstrate. Without electricity to help, we never could have met the demands for our food resources.

To win the war it was necessary for the Allies to have plenty of power and no lack of raw materials. An adequate supply of power meant an adequate supply of coal. Here again electricity was found to be of considerable help.

Go into almost any of our larger mines, and you will find that the coal in being wrested from the earth with the aid of electric drills, transported to the shaft of the mine under electric power, brought to the surface in hoists electrically operated, while electricity drives the pumps and does various other tasks. Moreover, the use of electric instead of steam power effects a saving of millions of tons of coal.

Electricity is indispensable in the mining and refining of those ores that constitute the raw materials of our iron. From its source to its final destination in any one of the thousands of manufactured iron and steel products that were essential to carrying on the war, you would be astonished at the frequency with which you would find electricity playing a part.

So with wood, with rubber and with other raw materials that went to the battlefront in so many different forms. In the actual manufacture of iron, steel, wood, rubber and other products, its light, its heat and its power were everywhere.

Then there was transportation—one of the most powerful of our instruments of war. Practically everything that was industrially produced had to be transported by rail or by water before it could be of service. What a strain the war had placed upon our transportation facilities everyone knows. Both on land and at sea, directly and indirectly, electricity accomplished wonders in promoting the handling of traffic with efficiency and dispatch.

Every train that moved over the rails represented the application of electricity at countless different points in its construction and operation. Rails, locomotives, cars—in the making of all of these electricity has had a part of no little consequence.

The dispatcher who directed the operation of the trains depended upon electricity to deliver his orders. Electric signals controlled the train's movements. In many cases, electric locomotives took the place of steam, saving coal and hauling heavier tonnage.

Electric interurban lines, by handling freight, relieved the tremendous strain heaped upon the railroads, while the importance of the fact that the country's urban street-car lines were increasing production by the saving of time must not be overlooked.

In the building and the operation of ships electricity played a bigger and bigger role every day, and today you will find great battleships equipped with electric drive, merchant ships propelled by electric power, vessels of all kinds lighted by electricity, protected by electricity and controlled by electricity.

Submarines are driven by electricity and require electric current for various other purposes. Without the electric spark in the engine, the aeroplane would be a dead thing. And this is true, too, of the motorcars, trucks, ambulances, motorcycles and other vehicles that were lending such a helping hand.

Rapid communication of all kinds of intelligence was another phase of war necessity that brought electricity into the foreground. The wireless, the telephone, the telegraph—how vital they were to our success and how vital to them was electricity.

Thus one could go on and on, deeper and deeper, into the maze in which one soon finds himself upon examining into electricity's part in the war. The ramifications are so extensive and the subject so closely related to so many activities that it is possible here to do little more than suggest its scope.

Was there another force so powerful in our war effort as this mysterious force of electricity? Is there another industry of which it can truly be said that it has done so much to help win the war as the electrical industry, which supplied the countless divers pieces of apparatus, appliances and instruments that made possible the widespread use of this force?

As electricity keeps the light shining in the torch of the Goddess of Liberty in New York harbor, so does it lend its potency to keep bright and clear the light of Liberty for all mankind.

ELECTRICAL CONTROL BY SOUND.

The control of electrical machinery by the sound of a whistle at any distance up to a mile was recently demonstrated in England. By the blowing of a whistle a small motor-car was started, directed to the right or left, and stopped by repeated sounds. The model was fitted with the essential batteries and no wires or wireless apparatus are claimed to have been used. Vibration alone was responsible, and the same results are claimed to have been accomplished by means of inaudible vibrations. The inventor, Capt. A. J. Roberts, an Australian flight captain, is said to have produced other inventions connected with wireless in the air and the control of torpedoes.

A New Form of Tank for Static Transformers

The Importance of Preventing Moisture from Entering Tank and Lowering Dielectric Value of Oil—How the Conservator Type of Tank Prevents This and Also Explosion Risk and Sludging of Oil

By W. S. MOODY

Engineer, Transformer Department, General Electric Co.

ENTRAPPED moisture is perhaps the greatest deleterious agent affecting high-grade insulation. The presence of an exceedingly small amount of moisture will reduce the dielectric strength of solid insulation to a mere fraction of its original value, by so changing the distribution of the dielectric stress as to cause a failure of what would ordinarily be a dielectrically strong structure.

In the early days indoor transformers were not even encased and outdoor transformers were placed

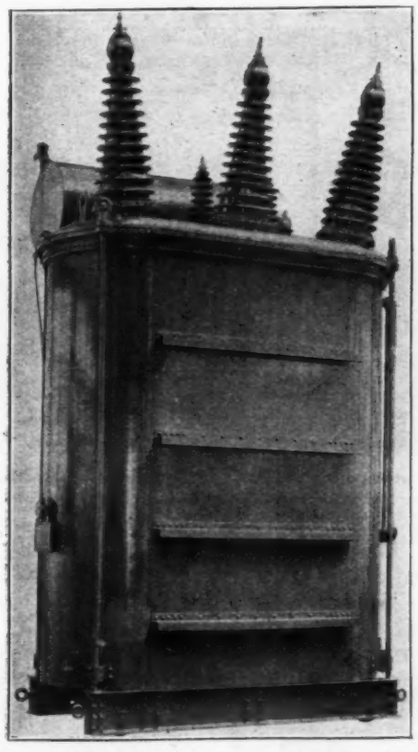


Fig. 1.—High-voltage Side of a Larger Three-phase Transformer With Oil Conservator.

in cases that were waterproof only under favorable conditions. As operating potentials increased, the necessity for a greater degree of protection against moisture was met by the use of oil and later by the impregnation of the fibrous insulation with moisture-proof compound previous to the immersion of the transformer in oil.

The sensitiveness of oil to water has long been known, the effect on the dielectric strength being shown clearly in Fig. 2. Satisfactory transformer oil when shipped from the factory should stand a test of at least 22 kilovolts between 1-in. disks spaced 1/10 in. apart and is unsatisfactory for high-voltage or large transformers when the dielectric strength is less than 75% of this value; that is, when it is below 16½ kilovolts. By reference to the curve it will be noted that oil of the standard strength, that is, 22 kilovolts, should have not more than 8 parts of water in 1,000,000 parts of oil, and that the addition of 10½ parts of water, giving a total of 18½ parts per 1,000,000, will reduce the dielectric strength to the lowest permissible limit. With increasing capacity and higher voltage, the necessity of almost absolute protection of oil against moisture was appreciated. With the demand for outdoor installations the details in design of tank, cover and lead construction were developed to avoid the possibility of the entrance of snow, rain or merely atmospheric moisture.

Evidently the most completely effective method of

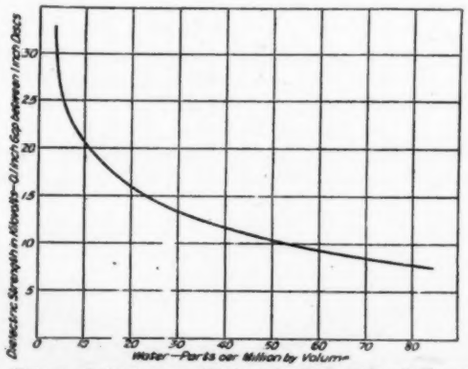


Fig. 2.—Effect of Water on Dielectric Strength of Transformer Oil.

accomplishing the necessary protection against moisture is to have the tank cover and terminals air-tight. This requires not only an expensive tank construction but also a large idle space air-filled above the oil level to limit the possibe internal pressure due to the expansion of the oil resulting from increase in temperature.

Explosion Hazard.

Due to chemical action in the transformer oil, caused by arcing or static discharges or heavy overloads, combustible gases (mostly hydrogen and light hydrocarbons) are sometimes set free, and in the ordinary tank these gases mix with the air above the oil so that a highly explosive mixture may be formed. This gas may be ignited by sparks of a static or dynamic character occurring along the leads, causing a dangerous explosion. While all General Electric high-voltage leads are provided with grounded shields that

make this impossible under ordinary circumstances, an abnormally low oil level may expose the transformer terminals, thus neutralizing the protection of the shields.

Sludging of Hot Oil.

Hot oil, even if carefully selected, will very slowly decompose when in contact with oxygen, and a precipitate will be thrown down. This decomposition or

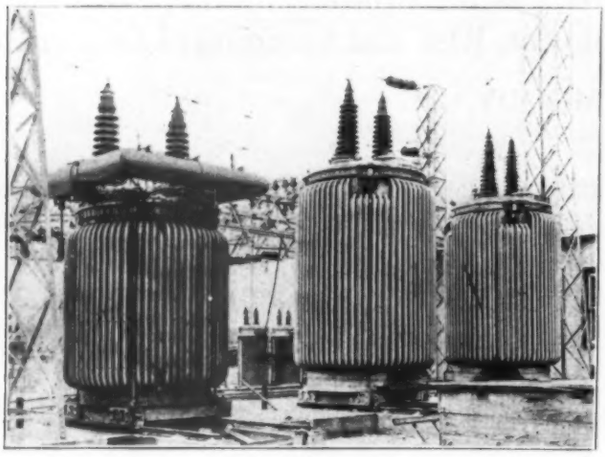


Fig. 3.—Initial Installation of Transformer Provided With Oil Conservator at Laurinburg, N. C.

sludging, while it does not affect the dielectric strength of the oil, increases the viscosity and thus retards the transfer of heat from the core and coils to the cooling surfaces. Even more deleterious is the fact that the deposit settles on the coil surfaces, in the ducts and on the cooling coils. This acts as a heat insulator on all surfaces and also will in time clog up the ducts.

The result is that the operating temperature gradually increases with consequent acceleration of the sludging. The remedy is found, first, in a method of oil refining that minimizes this action and, second, in a periodic renewal or filtering of the oil and thorough

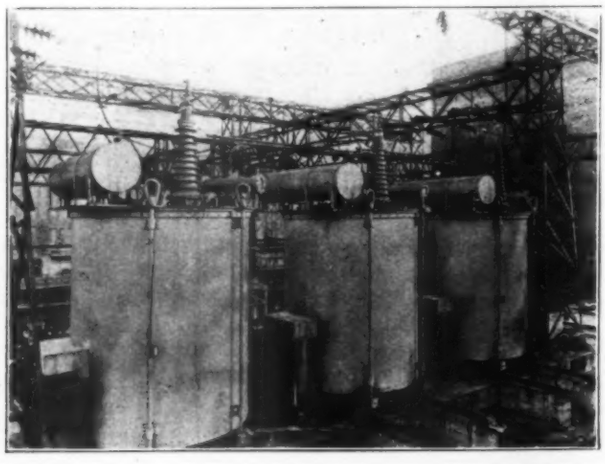


Fig. 4.—Transformers With Oil Conservators at the Windsor Power Plant of the American Gas & Electric Co.

cleaning of the core and coil surfaces. The oil regularly supplied with General Electric transformers is of such a quality as to practically exclude sludging under normal conditions, yet continued service with occasional overloads will eventually produce sludge.

An exhaustive series of tests has demonstrated that when air is not present the oil can be operated continuously at a temperature that would prove disastrous if air were present, with practically no sludge resulting. The results of one very severe test where the oil was subjected to a temperature of 130° C. for 18 days dmonstrated that when air was not present no sludge resulted—only a slight discoloration taking place, also that when air was in contact with the oil a heavy sludge was produced. This test is representative of many others and shows conclusively that for any permissible temperature sludging will not take place in oil so long as air is excluded.

Until recently, the most generally accepted solution of the problem provided for (a) the use of a tank substantially air-tight at all joints with a single vent or breathing point for the interchange of air between tank and the outside atmosphere, this opening being connected by a vent pipe to a chemical drying chamber to remove moisture from the air passing through it: (b) ground shields above the oil level, and (c) the operation with conservative temperature rise.

This construction, until recently the best available, has the following possibilities for improvement:

(1) An immediate indication of the oil-tightness of all joints, thus insuring absolute protection against the entrance of moisture.

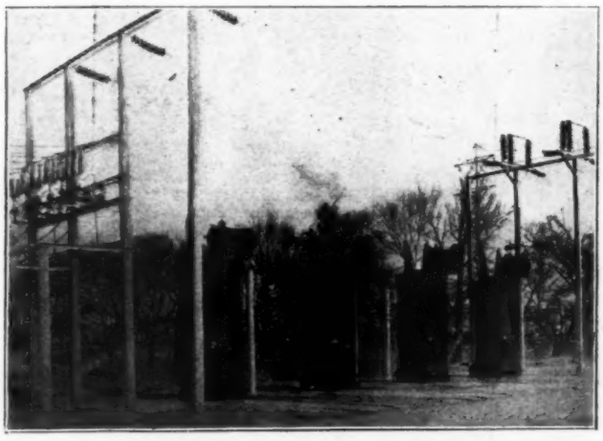


Fig. 5.—Outdoor Installation of Conservator-type Transformers of the Virginia Railway & Power Co., Richmond, Va.

(2) The elimination of all air space between the cover and the oil level.

(3) The reduction in the amount and temperature of the oil in contact with the air.

The indication of oil-tightness of joints will be a source of assurance to any operator of outdoor units. Elimination of the air space will insure protection against explosion due to the ignition of this atmosphere from corona or static between live parts and ground. The coolness of the air-exposed oil and the small surface in contact with the air will avoid the possibility of the oil sludging.

Oil Conservator Tank Construction.

These refinements in tank construction, which will materially reduce the possibility of failure even of apparatus as reliable as the best transformers, are all found in a valuable but simple addition to transformer tanks now extensively used by the General Electric Co. This device is sometimes called the "Oil Conservator." Figs. 1 and 4 show the general appearance of conservator-type transformers.

The engineers of this company have been testing this conservator construction in service during the past three years and are now generally recommending it for all large outdoor units. The conservator consists primarily of an auxiliary tank connected to the top of the main transformer tank by a suitable pipe and mounted somewhat above the level of the oil in the main transformer tank. When the auxiliary tank is supplied with oil the main tank and connecting pipe are completely filled and the only oil that comes in

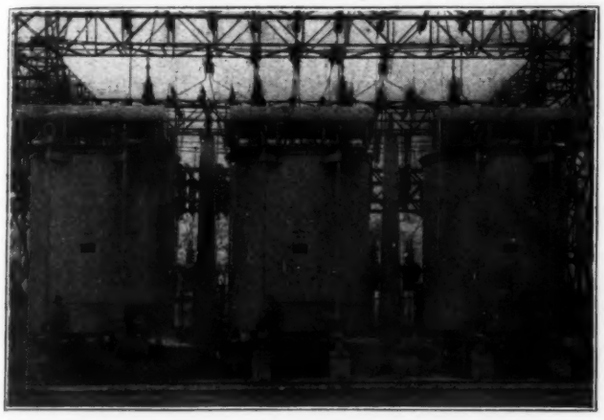


Fig. 6.—View of Transformer Bank No. 1 at Canton Substation of the American Gas & Electric Co.

contact with the air is that in the conservator. This is shown diagrammatically in Fig. 8.

The size of the conservator tank is governed by the expansion and contraction of the oil due to its changes in temperature. At the lowest operating temperature the oil must not contract so as to allow air to enter the main transformer tank, and at the maximum operating temperature the oil must not overflow the conservator. Transformer oil increases in volume about 4% with a temperature rise of 50° C. and this with other necessary allowances brings the volume of the auxiliary conservator tank to about 8% of that of the main tank. In practice, various refinements and

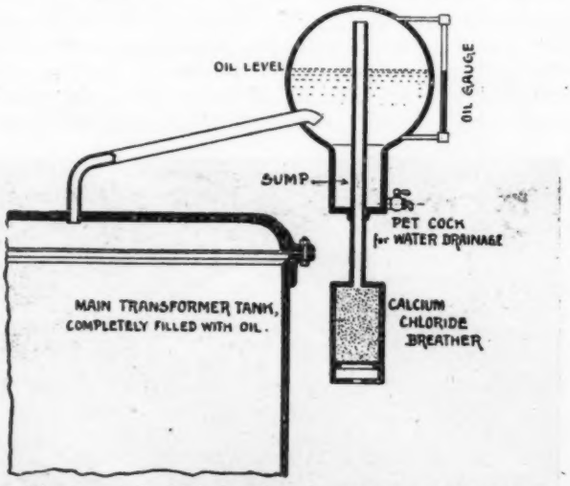


Fig. 7.—Diagrammatic Sketch of Oil Conservator Connected to Transformer Tank.

auxiliary devices are provided such as suitable oil gages, oil valves, chloride breather and sump.

Even a superficial consideration will show that this simple equipment fulfills the general requirements previously enumerated and a closer study reveals the fact that, even in detail, a better solution of the problems involved could hardly be desired.

Transformer Tank Completely Filled with Oil.

The fact that, except through extreme carelessness of the operator, the transformer tank will always be completely filled with oil has many advantages. The reduction in the necessary size of the tank and consequently of the bushings, has evident advantages. Elimination of the air space is of greater importance because with it is eliminated the chance of an explosive mixture of gas and air being trapped above the oil, for with the oil conservator any gas that may form immediately escapes into the auxiliary tank where there is, of course, no possibility of ignition.

Cool Oil in Contact With Air.

Since there is only one oil connection of limited size between the conservator and transformer tank, there is no circulation and the interchange of oil is limited to that due to the gradual expansion and contraction of the whole body of oil. The result of this is that the oil in the conservator is only slightly warmer than the outside air. To cite a typical test on a 95,000-volt conservator-type transformer of 3000-kv-a. capacity: the oil in the main tank reached a temperature of 73° C., while the oil in the conservator was only 38° C. Since the ambient temperature was 24° C., the temperature rise of the oil in the main tank was 49° C. against 14° C. for the oil in the conservator—three and a half times as great a rise. The importance of this on the sludging of oil can hardly be overestimated.

Figs. 3, 4, 5 and 6 are installation views that give some idea of the appearance of the conservator-type transformer in service. Fig. 3 is of especial interest as it shows the initial installation of the oil conservator in 1916 at Laurinburg, N. C.

RADIO CONTROL OF WIRELESS PROPOSED BY SECRETARY DANIELS.

Proposed Plan Calls for National Body to Supervise Private Stations.

A new policy for control and development of radio communication has been laid before Congress by Secretary Daniels.

It provides for maintenance of both naval and private stations, with the latter under control of a national radio commission, and proposes to open existing or new stations to general public correspondence at rates to be fixed by the Navy Department and Congress.

General public transoceanic correspondence through naval stations would not be permitted, however, except during temporary suspension of private service. Private radio stations would be licensed by the national radio commission and under its supervision.

CLEVELAND TO HOLD ELECTRICAL SHOW.

Plans are being made for holding an electrical show in Cleveland, Ohio, in February, 1920, according to an announcement by Matthias Turner, president of the Cleveland Electrical League. The early part of December was considered as a possible time for the show, but because of the rush of Christmas trade, February was selected. G. S. Milner of the Erner Electric Co. is chairman of the show committee.

IMPROVED EFFICIENCY OF MODERN PUMPING UNITS SHOWN.

Latest Installation at Minneapolis Water Works Also Shows Savings of Central-Station Service.

That the efficiency of centrifugal pumps is still improving and that under certain circumstances water works pumps can profitable be operated with central-station power is shown by the report of an acceptance test made upon the latest motor-driven pump installation at the Minneapolis water works.

The results of this test showed that in this pump installation a pump efficiency of approximately 86% was obtained and that the overall efficiency of the conversion of electric power to power measured in the water delivered averaged 82.48% over a period of nine months. A comparison of the costs of operating these pumps with the cost of operating the triple-expansion steam pumping units in the same station also shows the considerable saving obtained by the use of central-station service.

In May, 1911, the city entered into a ten-year contract with the Minneapolis General Electric Co., now the Northern States Power Co., by which that company agreed to furnish current at 2200 volts to operate two or more 20,000,000-gal. pumps against a dynamic head of 240 ft., based upon a pumping set of 72% overall efficiency, at a price of $4 per million gallons pumped, the understanding being that no current would be used between 4:15 p. m. and 6:30 p. m. on week days during the months of November, December, January and February. In November, 1916, a similar ten-year contract was made with the same company for the operation of a 30,000,000-gal. pump against the same head, and with the same pump efficiency, to be charged for at the same rate, with the provision that at a different dynamic head or efficiency the price per million gallons should be adjusted accordingly. It was also specified that the motor to be used by the city should be capable of starting the pump when primed and with the check or gate valve in the discharge closed, and of bringing the pump to full speed without drawing more than 150% of full-load current from the source of supply. In 1910 and 1911 two 20,000,000-gal. pumps were installed and in 1918 a De Laval pump.

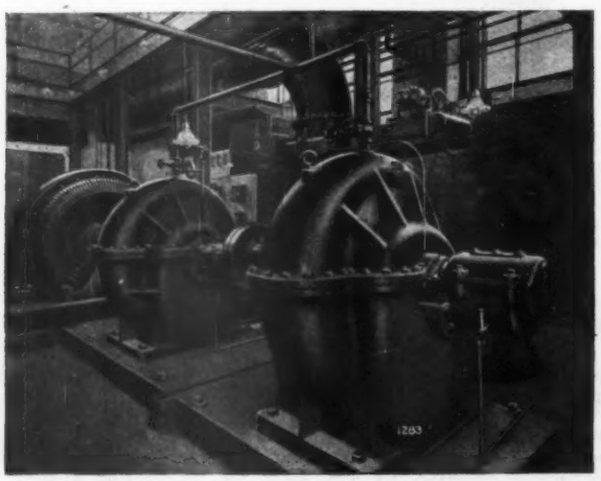
The latter unit consists of a General Electric 1800-hp., three-phase, slip-ring induction motor direct-connected to two De Laval 24-in. single-stage pumps mounted upon the same base plate and connected in series. The unit was specified to deliver 30,000,000 gal. per 24 hrs. against a total dynamic head of 250 ft. It was supplied by the Minneapolis Electric Equipment Co. and is installed at Pumping Station No. 4 in Northeast Minneapolis.

The official acceptance test was made in May, 1918. The discharge was measured by means of a Venturi meter, the capacity being calculated from manometer readings, while the discharge head was measured by two sets of calibrated gauges and the suction lift by means of a mercury column. The power supplied was measured by three sets of watt-hour meters, calibrated by means of a portable set of standard instruments reading during the official test under the conditions of current, voltage and power-factor obtaining. The portable set included two single-phase wattmeters, one polyphase wattmeter, one voltmeter, four ammeters and portable current and potential transformers. The test lasted 28 hours.

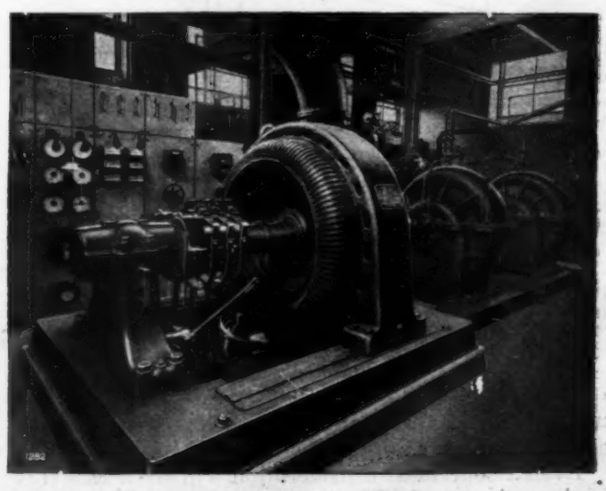
The results were as follows:

Total pumpage in 28 hrs.	37,719,500 gal.
Rate per 24 hrs.	32,331,000 gal.
Discharge head, average	235.13 ft.
Suction lift, average	16.43 ft.
Total dynamic head, average	251.56 ft.
Kw-hr. used	36,307.2
Combined efficiency of motor and pump	82.1%
Average line voltage	2,406
Power factor	90.0%
Motor efficiency under test conditions	95.5%
Slip of induction motor	1.1%
Temperature rise	33.5° C.
Starting current, percentage of full load current	113.0%

The contract of the city with the Minneapolis Electric Equipment Co. provided a bonus of $500 for each 1% efficiency exceeding 76% when pumping 30,000,000 gal. per day against a total dynamic head of 250 ft. The maximum bonus was limited to $2400. A penalty of $500 was provided for each 1% by which the efficiency might fall below 76% and the pump was not to be accepted if the overall efficiency fell below 72%. As the accompanying chart shows, 76% efficiency was exceeded at all loads tested, and the average combined efficiency, including the regular starting and other conditions incidental to a varying load in regular service, should not be less than 82.1% by more than 1%. The overall efficiency of 82.1% divided by the motor efficiency of 95.5% gives a pump efficiency of 85.97%. This is believed to establish a new record and is 6% higher than the results obtained in the tests on the pumps of another make installed by the City of Minneapolis under similar conditions. Service runs extending over a period of



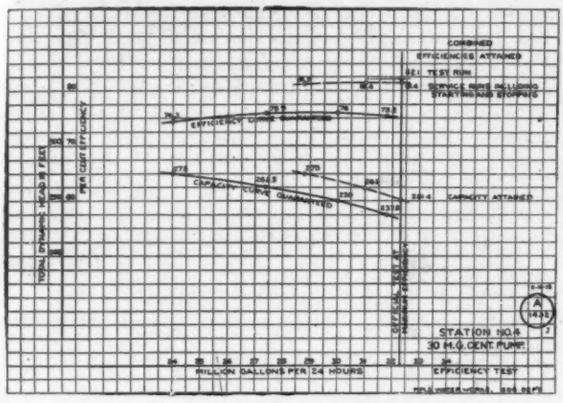
De Laval Motor-Driven Centrifugal Pump, 30,000,000-Gal. Capacity, Installed by the City of Minneapolis.



Motor End of Pump Unit Showing General Electric 1800-Hp. Motor.

three months show an excess of 5% over the efficiencies stipulated in the contract for various heads.

The test was accepted as correct by J. D. Marshall, of the Minneapolis Electric Equipment Co.; Wm. Salt of the De Laval Steam Turbine Co.; J. E. Jensen,



Head, Capacity and Efficiency Curves Showing Results of Tests on De Laval Pump.

supervisor of the Water Works Department, and E. C. York, engineer of Pumping Stations. The foregoing information is taken from the report of the official test by Prof. F. W. Springer of the University of Minnesota.

The following comparative operating data were obtained during the first three months after the test:

DE LAVAL 30,000,000-GAL. PUMP.

Gallons pumped	2,797,490,000
Power cost per million gal.	$3.63
Labor and supplies per million gal.	$2.27
Total cost per million gal.	$5.95
Head	253.06 ft.
Overall efficiency	81.4%

ANOTHER TYPE 20,000,000-GAL. PUMP.

Gallons pumped	421,340,000
Power cost per million gal.	$4.15
Labor and supplies per million gal.	$2.27
Total cost per million gal.	$6.42
Head	250.57 ft.
Overall efficiency	72.3%

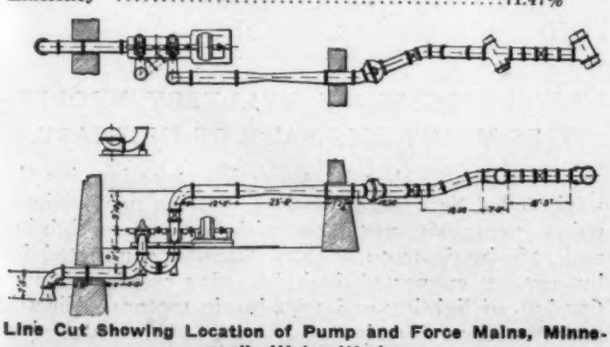
Similar records for the first nine months subsequent to the test are as follows:

DE LAVAL 30,000,000-GAL. PUMP.

Gallons pumped	6,526,350,000
Power cost per million gal.	$3.72
Labor and supplies per million gal.	$1.77
Total cost per million gal.	$5.49
Head	255.80 ft.
Efficiency	82.48%

OTHER TYPE 20,000,000-GAL. PUMP.

Gallons pumped	1,771,930,000
Power cost per million gal.	$4.33
Labor and supplies per million gal.	$1.77
Total cost per million gal.	$6.10
Head	257.80 ft.
Efficiency	71.47%



Line Cut Showing Location of Pump and Force Mains, Minneapolis Water Works.

Figures are also available from two triple-expansion Holly A-frame pumps installed in the same plant in 1903 and 1904, and tested in September, 1904. These pumps have a capacity of 15,000,000 gal. per day each, and on test developed a duty of 162,000,000 ft. lb. per 1000 lb. of steam, reduction being made for slip. During 1908 the two steam pumps raised practically all of the water for the city, namely, 6,518,000,000 gal., against 250-ft. head. The cost of fuel, using Illinois screening at $2.07 per ton, was $3.01 per million gal., the cost of labor $3.33, and other pumping costs 35 cents per million gal., making a total of $6.75. The cost today, with coal at $4.93 per ton, would be approximately $12.74 per million gal.

BRITISH ASSOCIATION FOR ADVANCEMENT OF SCIENCE MEETS.

Necessity of Providing for Power Supply One of Important Questions Discussed.

Until September of this year the British Association for the Advancement of Science has not been able to hold its annual congress since 1916, owing to the attention of most scientific men being occupied in some way or other with the war. This year's gathering therefore provided an opportunity for experts to describe and engineers and scientists generally to discuss some of the great achievements or discoveries of the war period in connection with engineering, electrical, chemical and physical science generally.

The meetings were held at Bournemouth, one of the largest of England's south coast health and holiday resorts, from September 9 to 13, and they were attended by some of the most eminent of British scientists such as Sir Oliver Lodge, Sir Charles Parsons, Sir J. A. Ewing, Sir Robert Hadfield, Sir J. Larmor, Sir Hudson Beare, Sir R. Gregory, Prof. H. E. Armstrong, Dr. A. P. Fleming, Professor Andrew Gray, Prof. W. H. Eccles, Prof. J. E. Petavel; and by leading industrialists and economists such as Sir Hugh Bell, Sir Herbert Morgan, Prof. A. W. Kirkoldy, the Rt. Hon. F. Huth Jackson, and so on.

There was a brilliant address delivered by the president of the association, Sir Charles Parsons, on the evening of the opening day when between one and two thousand members assembled in the famous winter gardens. For discussion of reports and papers members divided off into different sections as usual. The proceedings were full of interest though perhaps there was no special sensation unless it was provided by the excellent accounts that were given of achievements in such matters as aviation, wireless telegraphy, tanks, military bridge construction, turbines for ship propulsion, and other war work.

SIR CHARLES PARSON'S ADDRESS.

The president, in his opening sentences, said that the meeting was being held at a time when, after a great upheaval, the elemental conditions of organization of the world were still in flux and they had to consider how to influence and mould the recrystallization of these elements into the best forms and most economic arrangements for the benefit of civilization. The British association was capable of exerting a great influence in guiding the nation towards advancement in the sciences and arts. Sir Charles reviewed some of the most important features of engineering advance during the last twenty years. The turbine figured prominently among these. During the 20 years immediately preceding the war turbogenerators in-

creased in size from 500 kw. to 25,000 kw. and the consumption of steam decreased from 17 lbs. per kw.-hr. to 10.3 lbs. Ship construction, tungsten steel and investigations of gaseous explosions were mentioned. In regard to science and the war the speaker said that four years was far too short a time for much scientific invention to blossom to useful maturity, even under the forced exigencies of war and government control. In the past the great majority of new discoveries and inventions of merit had taken many years—sometimes generations—to bring them into general use. The work of the scientists during the war had perforce been directed more to the application of known principles, trade knowledge, and properties of matter, to the waging of war, than to the making of new and laborious discoveries; though in effecting such applications, inventions of a high order had been achieved, some of which promised to be of great usefulness in time of peace.

Sir Charles next discussed some of the important engineering developments made during the war such as tanks, aircraft, directional wireless with special reference to aircraft, emergency bridge construction and so forth. He particularized in regard to sound-ranging and listening devices.

In his section relating to electricity he referred to its rapid development in recent years in lighting, power transmission, in size of plants, etc. At the end of 1918 the central electric stations in the United Kingdom contained plant aggregating 2,750,000 kw., 79% of which was driven by steam turbines. The advantages and disadvantages of superstations were summarized and it was remarked that the greatest element in reducing the cost of electricity was the provision of a good load-factor. It was a far more important consideration than the size of the station. There was no golden rule to secure cheap electricity. The most favorable size, locality, and number of generating stations in each area could only be arrived at by a close study of the local conditions, but there was no doubt that, generally speaking, to secure cheap electricity a widespread network of mains was in most cases a very important, if not an essential, factor. The electrification of main line railways would no doubt result in a saving of coal; at the same time, the economical success would largely depend on the broader question as to whether the volume of the traffic would suffice to pay the working expenses, and provide a satisfactory return on the capital. Turning to consider the future, Sir Charles Parsons spoke as follows regarding the position of England:

"The nations who have exerted the most influence in the war have been those who have developed to the greatest extent their resources, their manufactures, and their commerce. As in the war, so in the civilization of mankind. But, viewing the present trend of development in harnessing water power and using up the fuel resources of the world for the use and convenience of man, one cannot but realize that, failing new and unexpected discoveries in science, such as the harnessing of the latent molecular and atomic energy in matter, as foreshadowed by Clerk Maxwell, Kelvin, Rutherford, and others, the great position of England cannot be maintained for an indefinite period. At some time more or less remote—long before the exhaustion of our coal—the population will gradually migrate to those countries where the natural sources of energy are the most abundant.

"The amount of available water power in the British Isles is very small as compared with the total in other countries. According to the latest estimates, the total in the British Isles is under 1½ million horsepower, whereas Canada alone possesses over 20 millions of which over 2 millions have already been harnessed. In the rest of the British Empire there are upwards of 30 millions and in the remainder of the world at least 150 millions, so that England herself possesses less than 1% of the water power of the world. Further, it has been estimated that she only possesses 2½% of the whole coal of the world.

"England owes her modern greatness to the early development of her coal. Upon it she must continue to depend almost exclusively for her heat and source of power, including that required for propelling her vast mercantile marine. Nevertheless, she is using up her resources in coal much more rapidly than most other countries are consuming theirs, and long before any near approach to exhaustion is reached her richer seams will have become impoverished, and the cost of mining so much increased that, given cheap transport, it might pay her better to import coal from richer fields of almost limitless extent belonging to foreign countries, and workable at a much lower cost than her own."

Sir Charles then went on to explain that "the average capital required to produce electrical power from coal is less than half the amount that is required in the case of water power. The running costs, however, in connection with water power are much less than those in respect of coal. Another interesting consideration is that the cost of harnessing all the water power of the world would be about 8000 millions, or equal to the cost of the war to England. Dowling has estimated the total coal of the world as over seven million million tons, and whether we appraise it at 25 cts. or more per ton its present and prospective value is prodigious. As coal is transportable long distances and, generally speaking, electricity is not so at present, therefore it seems probable that capital will in the immediate future flow in increasing quantity to mining operations in foreign countries rather than to the development of, at any rate the more difficult and costly, waterpower schemes. When, however, capital becomes more plentiful, the lower running costs of waterpower will prevail, with the result that waterpower will then be rapidly developed. As to the possible new sources of power I have mentioned molecular energy, but there is another alternative which appears to merit attention." Sir Charles referred to his proposal of 15 years ago regarding the sinking of a bore hole to a depth of 12 miles—ten times the depth of any shaft in existence, and later to the interesting phenomenon of intense pressure produced by moderate forces closing up cavities in water.

The chairman of the Mathematical and Physical Science Section in the course of his address quoted from his experience as a member of the British Ministry of Munitions, Inventions Department, for three years.

NEW BUSINESS OF BYLLESBY PROPERTIES MAINTAINS RATE OF INCREASE.

All Byllesby electric properties reporting for the week ended Sept. 29 show the following new business gains (net): 969 customers with 503 kw. of lighting and 1366 hp. in motors. New business contracted for but not yet connected includes 1812 customers with 677 kw. of lighting and 1315 hp. in motors. Electric energy output for the week was 9.7% greater than during the corresponding week last year.

Editorial Comment

Better Lighting of Highways

IT IS generally conceded that the lighting of our highways, especially those in the outlying country districts, is woefully inadequate. Of course, it takes time to provide proper facilities to cover the thousands of miles of main highways, let alone those of lesser importance. But with the increasing number of national and state highways and with the strides made in motor-truck and passenger-car transportation there comes a more insistent demand for better lighting to facilitate this traffic and help reduce the large number of accidents occurring at night.

Some progress has been made in automobile headlighting, but on the whole the attempt to light roadways by means of headlights without confusing and blinding drivers coming in the opposite direction is far from satisfactory. The numerous fatal and serious accidents on our roads at night show that the average headlight is by no means the ideal solution of the highway lighting problem.

From the technical standpoint the problem of lighting our highways presents almost no difficulties that have not already been solved satisfactorily in general street lighting. Use of suitable refractors permits the lighting units to be spaced at considerable intervals. On less traveled roads it may suffice to install only enough units to indicate the general lay of the road and illuminate dangerous spots and road signs.

But the problem is not so much a problem of furnishing suitable lighting equipment, installing it and keeping it in good operation as it is a problem of selling adequate highway lighting—of convincing the many county, town and village authorities involved that the need of good lighting is insistent and that the returns in the increased safety, utility and attractiveness of the roads warrant the investment and upkeep.

In this case, as in others, it seems that the electrical industry must act as a sort of little father to the laymen—by telling and showing them what is good for them electrically. And so there remains a great deal of pioneer work, especially the central station's, yet to be done before highway lighting in this country is adequate.

Taking the Customer Into Partnership

TAKING the customer into partnership with the utility by the sale of stock to the former by the latter is not a new idea. It is an old idea long advocated in these columns, long followed by many far-sighted utilities with eminent success. But this old idea assumes a new significance these days, when so many new conditions have to be met and so many new and ominous indications are appearing upon the horizon of our industrial and social life.

Take the customer into partnership by selling him stock. Ownership of property is a safeguard against the demagog's denunciation of private ownership, the tirade against the "capital" and the "moneyed interests." Ownership of utility stock by the customer and the public is an anathema to the socialists' and the syndicalists' demand for municipal and state ownership. He who owns property is not given to advocating uncontrolled and radical changes in ownership and civic life. He does not become intoxicated with the idea of taking away from those that have to give to those that have not. He believes in live and let live. He has faith in the durable things of life.

Few factors are more powerful for civic growth than the street cars and the light and power utilities. Civic pride is closely interwoven with the progress and the ideals of these forces in our civic life. The citizen who owns stock in the local utility feels pride the more for a "white way" or electric sign and a scenic railway is the pride of the town. The citizen that owns stock in the local utility is a better citizen, the utility is the better and the city is the better.

What would happen to a strike where every patron owned stock, where every employe owned stock? Who would strike? Would there be a strike? Much is said these days about profit sharing, but the form of profit sharing that comes from stock ownership is the best and the soundest form of profit sharing, for the rise and fall of prosperity affects all alike, hence is equitable and basically sound. The viewpoint of the worker must necessarily be different when he knows his labor brings a reward other than a fee or stipend. The knowledge that his profits depend upon the profit of those for whom he works, of himself and others, is an incentive to honest service, loyalty and stability.

According to the report of the Committee on Sale of Company Securities to Customers and Resident Citizens presented before the annual convention of the National Electric Light Association at Atlantic City, slightly more than $40,000,000 worth of central-station securities, representing 48 companies, have been marketed locally among employes, customers and residents. This is, of course, only a drop in the bucket, but it is indicative of what might be done. Think you, in the localities where this utility stock is owned by the people, that the people are demanding the forfeiture of franchises, are goading these utilities to bankruptcy and harassing them at every turn? Do we fully realize that when the radicals and the socialists and those other scions of labor speak of capital they speak of the worker, of the widow and the thou-

sands of the masses who have invested their dollars? These are "capital"; these are the ones whom the radicals would crush, in eliminating those to whom have been entrusted the dollars of the small investor.

Take the customer into partnership. Take the employe into partnership. Sell your stock, in its entirety, locally. To this extent we believe in public ownership. The sale of utility stock to customer, to employe and to local residents is a policy that is at once sound and wise. It is a policy that is extremely desirable at this time. It is a policy that creates a bulwark of good will in the community. And good will is needed now.

Influence of Extraneous Conditions on Transmission-Line Structures

THERE is often more than one way of doing a thing. Each may be a good way. Sometimes there is little difference in the different ways so far as concerns the results obtained. And yet one way is preferable because it may be safer, it may be cheaper, it may have longer life or may permit of being more quickly or more simply done. When all these factors are taken together, and balanced, that method whose summation comprises the greatest number of advantages with the fewest disadvantages is the best method. Circumstances alter cases, and some factor may carry special weight where some definite condition has to be met, whereas some other factor of little moment under the first condition may be the predominating factor where some totally different condition has to be fulfilled. It is the function of the engineer to weigh the pros and cons in each case, and decide or recommend accordingly.

In the design and construction of transmission lines conditions differ widely in different sections of the country, and sometimes along different sections of the same line. This is more especially the case in mountainous regions, where not only are long spans necessary, but wide variation in loading due to snow and sleet and temperature changes have to be contended with. Boggy country, rock formations are other factors that modify the form of construction used. Notwithstanding these facts, most transmission lines follow along each one much like another.

A closer inspection of these lines and a cursory study of local conditions may show, however, that there is some underlying condition to be met that influences the line in some manner. Elsewhere in this issue is described a form of installing poles for supporting a transmission line of the Western States Gas & Electric Co., that is of interest because none of the poles are embedded in the ground, but are purposely maintained on the surface, so as to get away from rapid butt rot. Each supporting structure utilizes two poles, each unit being guyed in four directions. The form of construction employed has been in use now for more than ten years, and has been found entirely satisfactory for carrying two circuits over long spans, and rugged country and where a high rate of butt rot has to be guarded against. Another rather unique installation presented in these pages some time ago was a case where the overhead steel grounded conductor and the two telephone lines were so installed across a long span that when the emergency arose any one of them could be employed for a phase conductor at 60,000 volts. In this instance, of course, it was a matter of arranging the conductors and jumpers at the anchor towers.

In our last issue, brief mention is made on page 622 of a form of line construction employed in Alabama during those days when it was urgent to construct a transmission line for immediate use, while at the same time foregoing the use of steel because of its high price and relative scarcity. At the same time the line was to be of a permanent nature. The manner of satisfying all these three requirements, rapidity of erection, conservation of steel and reasonably long life, was obtained by adopting what has been called a composite pole.

The composite pole consists of a steel tower braced to and supported by a wooden structure. In this way considerable steel was eliminated without seriously interfering with the permanency of the line, since the life of the line is determined by the life of the joints where the steel section is bolted to the wooden support, and these can be renewed as deterioration makes necessary. The wood-steel structures erected by the Alabama Power Co. are expected to have a life of not less than ten years, and when replacement of the steel-wood joints becomes necessary, or the wood supports are replaced by those of steel, the work can be carried on without service interruptions and excessive cost.

Transmission-line structures have undergone many changes, and different designs have been evolved to meet the many and varied conditions that obtain. So too, line insulators have kept pace with progress, the most radical being perhaps that of changing over from the pin to the suspension type several years ago. Today the suspension type insulator is standard for all transmission potentials of 60,000 volts and above, although it is often used for considerably lower pressures, where high factors of safety electrically and mechanically and similar requirements have to be met.

Although transmission lines have been quite well standardized, and one line looks much like another, there is still ample opportunity for ingenuity in both design and erection. Economy in first cost and operation and safety at all times are always of prime importance. Every innovation or practice that increases the safety, durability and immunity from trouble of a line, lowers the initial and after costs and adds to the flexibility is worth while. And the more engineers know about conditions existing in systems other than their own, and how those conditions were met, the better prepared are they to meet new problems as they arise.

Current Events

Proposed Reorganization of Jovian Order — Time and Place Set for N. E. L. A. Annual Convention Next Year

IMPORTANT PROPOSALS TO COME BEFORE JOVIAN CONVENTION.

Meeting in Chicago Next Month to Consider Revision of Name, Objects and Scheme of Organization—To Be Called National Electrical Board of Trade.

Mention was made in our last issue of the call for a convention of the Jovian Order to be held at the Hotel Sherman, Chicago, on Nov. 5 and 6. It is the general feeling of those interested in the order that it can be revived and reorganized on greatly broadened lines, subordinating to their proper place the social features heretofore so predominant, and developing the constructive business features. In line with these ideas, it is proposed to present to the convention for approval a comprehensive program of reorganization, the chief features of which are the following:

That the name of the Jovian Order be changed to that of "National Electrical Board of Trade."

That the organization, policy, plan of action, and objects and purposes of the National Electrical Board of Trade be so framed, by a revision of the existing Jovian constitution, that they wil be in complete harmony with all that the name implies.

That the suggested revision of the Jovian constitution be prepared by a Committee on Constitution appointed by the Seventeenth Jupiter, who shall, before drafting such revision, carefully survey the organization plans under which are now operating in other channels bodies similar to that of the contemplated National Electrical Board of Trade; as examples, the United States Chamber of Commerce and the International Association of Rotary Clubs.

That the Committee on Constitution (or a separate committee appointed by the Seventeenth Jupiter) shall also survey the needs of the electrical industry (with relation to the possibilities for service to meet those needs inherent within such an organization as outlined here), and shall prepare a standard of performance for the National Electrical Board of Trade, which shall include in specific detail the proposed activities of the board, and a budget covering the cost of operation for its first year and which if accomplished by the board will justify for it a continuance of necessary support from individual members, local boards and the electrical industry as a whole.

That the following suggested activities for the National Board be carefully analyzed by the committee and included, in the practical detail of their application, in the standard of performance, if they are found to be sound and feasible:

1. Public relations.
2. Relations between employer and employe.
3. Trade ethics.
4. Electrical merchandising.
5. Community advertising.
6. Salaried field representatives.
7. Trade data.
8. Foreign trade bureau.
9. Interrelations between electrical associations (hereinafter more definitely outlined).
10. Educational speakers' bureau (a corps of capable men to address monthly evening meetings of local boards).
11. Employment bureau.
12. A monthly publication.
13. Accident and health insurance.
14. Electrical expositions (possibility of traveling exhibits).
15. The Henry L. Doherty plan for the "conservation of human energy."

That the revised constitution and standard of performance be presented for the consideration of and action by a special meeting of the Jovian Order, called for the earliest date consistent with the requirements of the present Jovian constitution.

That the revised constitution provide practical means to permit of two classes of individual memberships, to-wit: One class of members who are also members of local Electrical Boards of Trade and whose dues to the National Board will therefore be paid by such local boards, as hereinafter noted; the other class, individuals who are not members of any local boards and who shall pay dues direct to the National Board, on the same membership classifications as outlined for local board dues.

That both classes of individual members in the National Board shall enjoy equal rights in so far as they deal in a direct line with the National Board, including the holding of national membership credentials inviting the enjoyment of the courtesy of visitors' privileges in all local boards.

That the fundamental scheme of organization as now existing in the Jovian Order be retained—to repeat, that of a vast individual membership whose interests and efforts are held in and invested by a great chain of local chapters, clearing through a central body, which shall have advisory and in proper measure supervisory powers in those matters affecting all local chapters.

That the ideal development shall not fall short of an individual membership of not less than 100,000 desirable, eligible men, working with and through local chapters established in every city and town capable of supporting an active electrical organization, no matter how small it may be.

That all of the present useful activities of the Jovian Order be continued in this evolution of that body, for this plan shall not in any sense be construed as destructive, but in every respect a constructive building upon the excellent foundation heretofore created through years of earnest Jovian endeavor.

That to emphasize the suggestion that one of the major activities of the National Electrical Board of Trade shall be the interrelations between electrical associations, attention be called to the following:

There are vital problems in the internal affairs of the manufacturing, jobbing, contracting, utility and other branches of the industry, each of which interest only indirectly the other branches, in which those other branches could be of small assistance and which are capably handled by the separate associations maintained by those groups.

Also, there exist questions of great moment to all branches, to the entire industry, which should be acted upon by all associations as a unit with standardized policies and methods, to insure harmony, effective results and avoidance of a duplication of effort; there is nonexistent today for such united effort any vehicle completely meeting the need.

As one example of the usefulness of such an agency may be cited a destructive condition generally considered as the problem of the public utility alone but which in reality strikes at the heart of the earning power of every man drawing his income from the field of electricity. This condition is that of the feeling and expression of criticism, suspicion and resentment manifested by press and public in far too many communities and one of the most potent sources of trouble in the industry. It operates directly and indirectly against progress and growth of utilities by inciting unfair, restrictive legislation, cutting down revenue and making necessary capital wary and difficult.

That to remedy that condition should be the fight of every electrical man and association is surely obvious, because, when central stations, street railways and telephone and telegraph companies, the great purchasers of electrical apparatus and supplies, are expanding and prospering, then all down the line, in every branch of the industry, "Business is good." Quite the reverse when the utilities are harassed and depressed to the point of stagnation and retrenchment.

In a great majority, if not in all instances, public distrust

is the result of gross ignorance of the policies, basis of earnings, methods of operation, ideals and official personnel of utilities.

The remedy for ignorance is education. Therefore, the whole electrical industry, each man in it, through a standardized, far-reaching plan of action adopted by all electrical associations, should be saturated with educational, preventive and protective propaganda to be by him spread broadcast to the public by every possible means.

This is only one example of the need for a clearing-house for electrical associations; there are many more.

To supply in a satisfactory manner the required agency it is suggested that the revision of the Jovian constitution provide that there be nominated and elected (in a democratic manner representative of all individual members) as the controlling body of the National Electrical Board of Trade, what will be in effect and possibly in name a board of directors, in which shall be included three members selected from each association maintained by each of the recognized groups or branches of the industry, chosen with the approval and co-operation of the respective associations. There shall also be included in this governing body one or more members-at-large and such other members as a thorough study of the plan suggests.

This plan not only furnishes the common ground of contact for all associations, but fairly places in the hands of each branch its share of the control of the National Board, which draws its support from the entire industry.

That the National Electrical Board of Trade be financed by the dues of individual members paid direct to it by those members who are not also members of any local board; also, by payments made quarterly or semiannually by each local board, the amount based on a per capita tax for each member of such board; this local board payment to constitute payment in full for membership of both the local board and each of its members in the National Board.

That the per capita tax for the first year shall be in the sum of $2; at the expiration of that period the tax to remain at $2 or be increased or decreased in harmony with the quality and extent of the service rendered by the National Board, the cost of that service and the gross revenue of the National Body.

That the matters covered herein and as enlarged and made more definite through the procedure and committees recommended be submitted at the earliest possible time as a complete plan, capable of supplying a greatly needed instrument, to the more important electrical interests by a committee named by the Seventeenth Jupiter, with the request that those interests immediately underwrite the necessary operating expense of the National Board during the period in which the plans are being put into effect, these underwriting payments to be repaid in the event and when this reorganization project shall be established on a self-supporting basis.

That the present Jovian constitution be amended to permit action upon constitutional amendments at special meetings called in accordance with the provisions of the constitution.

MISSOURI STATE ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS HOLDS ANNUAL MEETING.

Seventeenth Annual Meeting Taking Place This Week in St. Louis.

The Missouri State Association of Electrical Contractors and Dealers held its seventeenth annual convention at the American Annex Hotel, St. Louis, Mo., Oct. 17 and 18, respectively. The first session was devoted to association business and to the presentation of a paper by R. E. Stewart, of the Stewart Electric Co., St. Louis, on the important subject of "Wiring of Old Houses." The second session on Friday consisted of an address by William L. Goodwin on "The Goodwin Plan." Friday evening the contractors were invited to a dinner given in their honor by the Electrical Board of Trade of St. Louis.

At Saturday morning's session Samuel Adams Chase, of the Westinghouse Electric & Manufacturing Co., made an address on the vital importance of co-operation of the contractor-dealers with the different electrical interests and their effect on the contractor-dealer. A paper on "Cost Finding and Accounting," lack of which may lead to bankruptcy, a proper system of which only can lead to success, was presented by J. A. McShane.

In the afternoon A. Penn. Denton read a paper explaining the objects and aims of the Bureau of Education and Research. Arthur Brandt, Frank Adam Electric Co., read a paper on "Electrical Merchandising." "Operation of Electrical Repair Shop and Sale of Used Electrical Machinery" is the title of a paper presented by Fred E. Briner, of the C. J. & F. E. Briner Electric Co., and two other papers of interest to contractors and dealers given were "Operating a Contractor Business in the Residence Section of a City" by Samuel J. Burke, Burke Electric Co., and "Desirability of Having Electrical Contractors Affiliate, as Associate Members, of the National Fire Protection Bureau" by George Dose.

ELECTRIC CLUB GIVES LUNCHEON IN CONNECTION WITH CHICAGO ELECTRICAL SHOW.

Samuel Insull Makes Address on Development of Electrical Industry, Giving Broad Summary of Conditions Existing in Electrical Field.

Tuesday, Oct. 14, was Electric Club day at the Electrical Show being held at Chicago, Ill., and at a luncheon attended by over 300 members Samuel Insull, president of the Commonwealth Edison Co., Chicago, was the principal speaker.

Mr. Insull first paid a tribute to the members of the electrical fraternity in the army and at home who helped win the war, and said such organizations as the Electric Club of Chicago rendered invaluable assistance.

"The Development of the Electrical Industry" was Mr. Insull's subject and he touched upon it only in a broad way. The capital of electrical manufacturing companies in this country is estimated at $750,000,000, with a yearly turnover of $600,000,000, while the capital of central stations is estimated at $2,750,000,000 with a turnover about the same as that of the manufacturers. Inasmuch as the success of the industry is greatly dependent upon the success of the central stations, and in view of the fact that central stations require such large capitalization for corresponding turnover it is necessary that the stability of the latter be preserved. This can be accomplished by allowing them legitimate profits, secured through intelligent regulation by state commissions. Team work within the industry is also necessary to make central-station stability permanent.

Most utilities, such as electric railway companies, encountered financial difficulties during the war and the situation has not been relieved to any great extent. The nature of their business has made central stations more fortunate in this respect, although much distress has been caused by unfair regulation by public service commissions, resulting in a marked loss of stability by these central stations affected and making it difficult for them to obtain capital for needy purposes. Stress should be laid upon this situation so that central stations will receive fair regulation, enabling them to make a profit so that investment in them will be stimulated. In this way only can funds be secured to make the line extensions that are needed and which are necessary to the success of the electrical industry as a whole. Mr. Insull said he was sounding

no note of alarm, but that increasing labor and material costs made just regulation of utilities imperative and relief was necessary.

In reviewing the development of the industry, statistics on central-station progress were given. Aug. 1, 1919, marked the twenty-fifth anniversary of the opening of the Harrison street power station (now dismantled) of the Commonwealth Edison Co. When first opened it was considered the most modern of any in this section of the country. Its total capacity was one-half that of turbines now purchased by the company. Its total output covering 24 years of operation, about 550,000,000 kw-hr., is less than that of either the Fisk or Quarry stations for one year. The company's maximum load at the time the station was first installed was 6000 kw., while last December it was 400,000 kw. The number of customers has increased from 4000 to 400,000.

In closing, Mr. Insull appealed to those present, as citizens and in the interests of business, to make a concerted effort toward stamping out radicalism and all elements that tend to injure the security and stability of business.

VAIL LIBRARY THIRD LARGEST ELECTRICAL LIBRARY IN U. S.

One of the most notable collections of electrical literature in this country is the Vail Library. It comprises about 20,000 volumes, which includes books on electricity, magnetism, electrical engineering, electrochemistry, electrometallurgy, electrotherapeutics, world expositions and electrical congresses. The collection was originally made in England and was purchased in 1912 by Theodore N. Vail, president of the American Telephone & Telegraph Co., who gave it to the Massachusetts Institute of Technology. It has been cataloged and brought up to date by the addition of about 1000 new books. The institute has given a large room in the main building for the Vail Library, which is open to the public as well as the students for reference and research.

MASSACHUSETTS INSTITUTE WIDENS ELECTRICAL ACTIVITIES.

Need for Research, Application and Other Factors Necessitate Raising Endowment Fund of $10,000,000.

"We have reduced ourselves to a one-tenth-of-a-second world," says Prof. Arthur E. Kennelly, director of the Research Laboratory of Electrical Engineering at the Massachusetts Institute of Technology. One of the greatest achievements of the war, according to Professor Kennelly, was getting around the world by radio. Many times messages were sent successfully from Carnabon in North Wales to Sydney, New South Wales, which is practically at the antipodes. These signals in all probability arrived at the antipodes in less than one-tenth of a second from the time they started. That means that all our radio communications in the future are necessarily compressed within a period of time which is less than the antipodal period of one-tenth of a second.

The evident result of that shrinkage, the Technology professor believes, will be to force us into close international touch, and this will render necessary a readjustment of our international relations. We will have to maintain an international language, an international system of weights and measures—the metric system—and a code of international law. The League of Nations is just the beginning of the consequences that will have to be thought about as a result of the close electrical communication throughout the world.

The Massachusetts Institute is raising a $10,000,000 endowment fund this autumn to keep abreast of the times, and Professor Kennelly believes this move is justified along many lines. The war has brought about a remarkable development in all branches of applied science and the Institute of Technology needs new apparatus in her laboratories and new blood in her teaching staff to give the students the sort of training they ought to have. In Professor Kennelly's own field, electrical work of all sorts is advancing so fast that it takes the best they can do to keep up with it. Reading and laboratory work—the accomplishments of the research laboratory for one year—furnish the material for teaching in the next. Already electrical courses are given at Technology that would not have been possible had it not been for the laboratory work of the preceding year.

Professor Kennelly is giving a new course on electrical communication this year, a course made necessary and possible by reason of the experience gained in the war, where all kinds of electrical signalling were resorted to under stress. A special group of students is being assigned to it from the Signal Corps of the United States Army. They will study the principles of telegraphy, telephony and radio, together with the numerous methods, both practical and theoretical, that are involved.

Radio and radio methods are coming to be introduced more and more generally into electrical communication in civil life. In radio telephony a very small amount of the energy inside of matter is released so that mankind is just commencing to unlock the enormous stores of energy within matter, very much greater than the energy released by coal in burning. All studies made in the laboratory at any time would be of incalculable value to industry if the secret of unlocking that energy could be revealed. It would probably be unfortunate, howeve, if we did succeed in releasing it all at once.

ELECTRICAL MANUFACTURERS HOLD SECTION MEETINGS.

Many Sections of the Associated Manufacturers of Electrical Supplies Hold Sessions at the New York Headquarters and Also One in Chicago.

On Oct. 14 to 16 of this week many of the important sections of the Associated Manufacturers of Electrical Supplies held regular meetings at the headquarters of this association, 30 East Forty-second street, New York City. Over 300 manufacturers were in attendance. Each of the sections holding a meeting was strongly represented by delegates from its particular group. The general progrems of each of the section meetings included earnest discussions on practical details of manufacturing and marketing electrical supplies. Among the sections which met in New York City were the following: Signaling Apparatus; Lamp Receptacle and Socket; Industrial Lighting Fixture; Snap Switch; Attachment Plug; Outlet Box; Fuse; Knife Switch; Insulating Materials; Panelboard and Switchboard; Molded or Formed Insulation; Line Material and Air Circuit-Breaker. The Heating Appliance Section held a meeting in Chicago on Oct. 14.

N. E. L. A. Selects Pasadena for Next Convention

Convention Will Be at Hotel Huntington May 18-21, Inclusive—M. H. Aylesworth Made Executive Assistant to the President—Other Important Association News

PASADENA, pre-eminent among the beautiful cities of Southern California, was selected as the seat of the next annual convention of the National Electric Light Association. It will be a four-day gathering from May 18 to 21, inclusive, and will have many distinctive features to mark it among the notable meetings held by this influential organization.

Decision as to the time and place of the next convention was reached at a meeting of the Executive Committee of the association held in New York on Oct. 2, at which President R. H. Ballard, of Los Angeles, presided. The Hotel Huntington was selected as the headquarters of the convention. Mr. Ballard obtained an agreement with the hotel to reserve it for the exclusive use of N. E. L. A. members, and stated that if the accommodations at this hotel are not sufficient for all who wish to attend, the western delegates will stay at other hotels in Pasadena so as to give the preference as to the Hotel Huntington's facilities to delegates from distant parts of the country.

Matters relative to the next convention were not the only ones decided at the committee meeting referred to. The presence of President Ballard made it possible to reach conclusions on a number of other very important features, one of these involving the selection of an administrative director of the assocciation's affairs, M. H. Aylesworth, of Salt Lake City, being chosen for this important position. On account of the importance of the matters considered at the meeting, the following condensed report abstracted from the minutes will no doubt prove interesting to all central-station men.

Geographic Sections.

As chairman of the Committee on Geographic Sections, appointed at the last meeting of the Executive Committee, R. J. McClelland reported that the committee had agreed upon a division of the country into geographic sections and presented a map of the United States showing the proposed divisions which had the approval of Vice-President Bump.

President Ballard stated that what he had in mind for the Executive Committee was merely a tentative approval of the plan of dividing the country into geographic sections, that the report of Mr. McClelland's committee might be received and published in the *Bulletin* as representing the best judgment of the committee, subject always to the desires of the members living in the existing and proposed sections. The committee would thus have an opportunity to check up with the members the arguments for and against large and small geographic sections. The adoption of the report along those lines would not commit any section to any definite boundaries. Mr. Ballard added that in order to get an idea of the opinion of the committee's plan in different parts of the country, a number of telegrams have been sent out and very enthusiastic replies have been received from a number of men resident in different sections of the country.

Mr. Ballard reported that the Public Policy Committee had appointed a committee consisting of W. W. Freeman, chairman; Joseph B. McCall and Frank W. Smith to confer with the Committee of One Hundred of the Electric Railway Industry.

Appointment of Mr. Aylesworth as Executive Assistant to the President.

President Ballard advised the committee that he had discussed with the Public Policy Committee the employment of a man to act in an executive capacity with title of assistant to the president and to be located at headquarters. He had suggested the name of M. H. Aylesworth, of Salt Lake City, Utah, and his qualifications and recommendations had been discussed with the Public Policy Committee, with the result that the members of this committee were of the opinion that the employment of Mr. Aylesworth in this capacity would be of benefit to the association and they recommended his employment. Mr. Ballard advised the Executive Committee of the work Mr. Aylesworth had done in the past, stating that the four vice-presidents had all met him, and were favorably impressed with his record and general qualifications for the position. John A. Britton, chairman of the Public Policy Committee, spoke in favor of the creation of the new position and the employment of Mr. Aylesworth. On motion it was voted to authorize President Ballard to engage Mr. Aylesworth as assistant to the president.

Mr. Bump suggested that Mr. Sewall be continued as acting secretary for the present, leaving it to Mr. Aylesworth to make his own organization. The president appointed Mr. Sewall acting secretary and on motion the appointment was confirmed.

T. C. Martin's health having improved, the president, with the concurrence of the Public Policy Committee, recommended his appointment as advisory secretary of the association, devoting part of his time only to association affairs on matters referred to him by the president or his representative, and that in consideration of Mr. Martin's valuable services to the association in the past in the active duties of secretary, this position be offered to Mr. Martin for life. On motion it was voted to approve the president's recommendation. On motion the president was authorized to appoint a committee to draw up suitable resolutions memorializing the splendid work which Mr. Martin has done for the association and the industry at large, these resolutions to be spread upon the records and an illuminated copy to be sent to Mr. Martin. President Ballard then appointed J. W. Lieb, Charles L. Edgar and Henry L. Doherty as this committee.

Mr. Ballard then called upon Mr. Britton, chairman of the Public Policy Committee, to address the Executive Committee, and Mr. Britton made an inspiring address, dwelling upon the wonderful possibilities for good work ahead of the association.

Convention Plans.

On motion it was voted to hold the 1920 convention in the Hotel Huntington, Pasadena, Calif., from May 18 to 21, inclusive. President Ballard stated that the hotel will be reserved for the exclusive use of N. E. L. A. members, and that if accommodations are not sufficient for the entire convention, the western delegates will stay at the other hotels in Pasadena.

President Ballard outlined his plans for the Pasadena convention, confining the general work to morning sessions at which the most important subjects of the national special sections will be presented, the afternoons to be devoted to such parallel meetings of the sections as may be absolutely necessary. Mr. Ballard asked the members of the Executive Committee to write him of any ideas or suggestions they may have regarding the convention plans.

It was voted to appoint George W. Elliott as master of transportation to arrange for special trains, etc., for the nearly 2000 members that may attend.

Committee Chairmanships.

President Ballard reported that Franklin T. Griffith, president of the Portland Railway, Light & Power Company, of Portland, Ore., had accepted chairmanship of the Committee on Water Power Development; that S. M. Kennedy, general agent of the Southern California Edison Co., of Los Angeles, had accepted chairmanshop of the Committee on Service, and that Lee H. Newbert, manager of the commercial department of the Pacific Gas & Electric Co., of San Francisco, had accepted the chairmanship of the Committee on Co-operation in the Industry, all of which appointments were confirmed by the Executive Committee. Mr. Ballard also reported that M. S. Sloan, president of the Brooklyn Edison Co., had agreed to act as chairman of the Committee on Electrical Resources of the Nation, which appointment was confirmed.

Chairman F. A. Birch, of the Company Sections Committee, reported that there were 23 active sections at the present time and that the committee is devoting special attention to the old sections that are inactive or have disbanded, in an effort to induce them to reorganize. A personal visit will be made during the year by some member of the committee to each of the active sections. Mr. Birch emphasized the great value of company sections not only to the individual members, but to the management of the companies on account of the many subjects which the sections can discuss of common interest.

President Ballard reported that Charles B. Scott, H. J. Burton, and Wills Maclachlan had represented the association at the Public Utility Section of the National Safety Council at its congress held in Cleveland, on Oct. 1 to 4.

President Ballard referred to the convention of the Illuminating Engineering Society to be held in Chicago, Oct. 20 to 23, and stated that a number of Commercial Section committee meetings are to be held in Chicago during this same week, thus assuring cooperation as some of the commercial members will undoubtedly attend sessions of the society.

The Convention City.

A keen competition for the honor of holding the convention was participated in by five cities of the southern part of California, these being Los Angeles, Santa Barbara, Riverside, San Diego and Pasadena. The invitations from Pasadena took the form of a telegram to the Executive Committee from all of its civic bodies. The choice fell to Pasadena, because of its excellent hotel accommodations; the fact that it is only nine miles from Los Angeles, the metropolis of the extreme Southwest, and because the Hotel Huntington, beautifully situated in the San Gabriel valley, can provide quiet and restful hospitality for those who attend the convention.

The Executive Committee is in receipt of telegraphic advices from Pasadena that the Maryland

Hotel Huntington, Pasadena, Cal., Where the 1920 Convention of the National Electric Light Association Will Be Held—The San Gabriel Valley, the Sierra Madre Range and Mount Wilson in the Background.

and Green, both large tourist hotels, will reserve sufficient rooms to accommodate the overflow of visitors who cannot be cared for at Hotel Huntington.

Pasadena, known as the crown city of the San Gabriel valley, is world-famed as a summer and winter tourist resort, and the home city of many millionaires, authors, artists, and celebrated people. It lies almost directly beneath Mount Wilson, and the mountains of the Sierra Madre Range from a crescent to the north. In every direction the wonderful automobile roads for which southern California is renowned, lead out through labyrinths of orange groves and down to the Pacific and a dozen of its famous seaside resorts.

President Ballard has received wire advices from Los Angeles, his home city, that the civic bodies of Pasadena and the several large electric corporations which operate in the Southwest will co-operate with the committee of the organization in providing entertainment for the tourists and their families, which will make their visit to southern California an event of unprecedented pleasure.

The Executive Assistant to the President.

M. H. Aylesworth, the newly appointed executive assistant to the president of the association, fills a newly created office with duties amounting to those of operating executive of the association.

Mr. Aylesworth is a young man, a lawyer by profession, being a graduate of the University of Colorado and University of Wisconsin ('06). He has, however, been closely identified with public utility matters most of the time since his graduation. He was for four years chairman of the Colorado Public Utilities Commission; subsequently, and until his present appointment, he was in charge of public relations and public policy work for the Utah Power & Light Co., the Utah Light & Traction Co., and the Western Colorado Power Co., having the position of assistant to the vice-president and general manager.

During the war Mr. Aylesworth was chairman of the Fifth Regional Committee of the National Committee on Public Utility Conditions.

Campaign to Nationalize Work of the Association.

The ambition of the new administration will be to bring into the association every electrical utility in the United States. A vigorous campaign will be instituted to nationalize the work of the association more than heretofore, especially in view of the numerous and difficult after-war problems of the utilities, and to bring its influence into every geographical section of the country. Mr. Aylesworth is a strong advocate of concentrating on service to the public in such a manner as to increase understanding of the business of a public utility among the people at large.

Mr. Aylesworth comes to his new position—he has only been in harness a few days—thoroughly in accord with Mr. Ballard's slogan, "Everybody works." Preparations have already been made since his coming to association headquarters in the Engineering Societies Building to enlarge these quarters and make them adaptable to the campaign work in view. The association has taken an entire floor and this is being rearranged throughout. A very attractive feature will be a large members' room with desks and stenographic facilities. It is hoped that representatives of any of the member companies who will come to New York will make this room their headquarters.

ELECTRIFIED TRAINS TO SEATTLE IN A FEW MONTHS.

Final Arrangements Being Made to Complete C. M. & St. P. Electrification from Othello to Seattle.

All of the heavy work of electrifying the Chicago, Milwaukee & St. Paul railway from Othello to Seattle, Wash., has been completed, but there are innumerable small tasks to be completed to make it possible to handle electric locomotives at all points and to insure operation without a break. None of the remaining jobs is large in itself, but in the aggregate they involve considerable labor and expense, arrangements for which were recently completed by General Manager Earling while in the East.

It is not expected by the company to operate freight trains through to Puget Sound by electricity before the middle of November and the complete electrification of the line will not be finished before January.

Electric locomotives have been in operation west of Othello over the Saddle Mountains for more than a month.

ELECTRIC TRUCK VETERANS STILL IN SERVICE.

Interesting Exhibits at New York Electrical Show Demonstrate Serviceability of Electric Trucks.

That the electric truck gives long years of service was very convincingly shown by the Automobile Bureau of the New York Edison Co. in an exhibit at the New York Electrical Exposition which closed Oct. 4.

Two trucks, one with a 16-year and the other with a 14-year service record, were on view, while a statistical chart showed the number of electrics of all ages that were in service on Jan. 1, 1919.

The 16-year old truck was a lamp wagon used for delivery purposes by the electric light company. The 14-year old vehicle was lent to the exposition by Aitken, Son & Co.

On the statistical chart it was shown that there are now 2044 electrics of at least 5-year service; there are 980 8-year-olds, 221 in the 10-year class, 106 that are 13 years old, 33 in service 15 years, 25 in service 16 years, 11 in service 17 years and 2 that are 18 years old.

The exposition's electric-vehicle display included trucks, a fire engine, passenger cars, industrial trucks, a tractor and storage batteries.

ELECTRIC HEATERS PROVE TO BE GOOD SELLERS IN MINNEAPOLIS.

Sixty-six Electric Heaters Absorbed by Public During Week as New Customers Are Connected Up.

The sales department of the Minneapolis General Electric Co. reports the sale of 66 electrical heaters during the week ended Sept. 29. During the same week the department secured 489 new electric customers with 287 kw. of lighting and 189 hp. in motor equipment.

Net gain in connected load includes 304 customers with 262 kw. of lighting and 565 hp. in motors. Electric energy output for the week was 35.7% greater than for same week previous year.

Commercial Practice

Dayton's Successful Electric Iron Campaign—Store Lighting — Reduction of Fog Electrically—It Pays to Advertise

CHART DRAWN BY PACIFIC GAS & ELECTRIC CO. PROVES ONCE AGAIN THAT "IT PAYS TO ADVERTISE."

Relation Between Advertising and Sale of Utility Stock Emphasizes Value of Maintained Publicity.

It has often been stated that "it pays to advertise." In fact, it is a truism accepted everywhere by practically everybody. The accompanying chart shows in

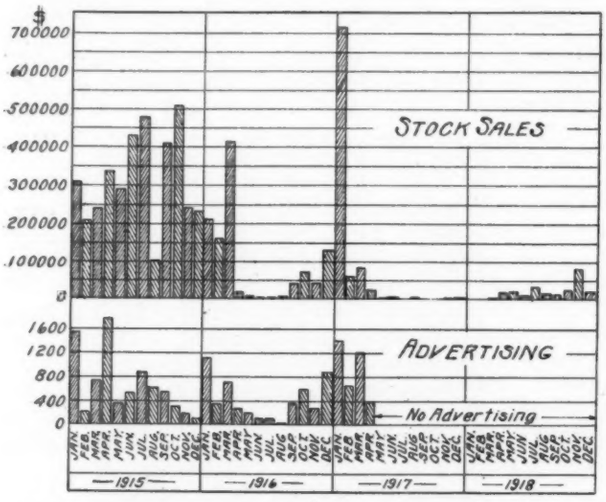


Chart Showing Relation Between Advertising and Stock Sales, Showing Manner in Which Stock Sales Fluctuate With Advertising.

a very interesting and illuminating manner the influence that advertising exerted upon the sale of stock in the case of the Pacific Gas & Electric Co.

The Pacific Gas & Electric Co. has been one of the prominent companies to take to that very sound policy of selling its stock to its employes and its patrons. The company introduced its present policy about June, 1914, and since that time has proved again and again that such a policy is sound basically and advantageous from every aspect. In these days when there is such commotion going on among demagogs for state and municipal ownership, and when bolshevism is creating so much noise, the ownership of property is one of the factors that enables such movements to fail. Ownership in utility stock creates interest and allays friction; it puts a stop once and for all to the cry of municipal ownership and makes the stock owner realize that the term "capitalist" applies to anyone who has one dollar or more in the bank or owns a lot or employs labor to work for him.

The Pacific Gas & Electric Co. has found, as so many other utilities have found—and as the Government has found since inaugurating its campaigns for War Savings Stamps and its Victory and Liberty Loans—that the public will subscribe when sound investments are properly presented. To sell stock to the utility patrons as well as to the employes is sound business, and many are the utilities that could do still more to take the customer into partnership.

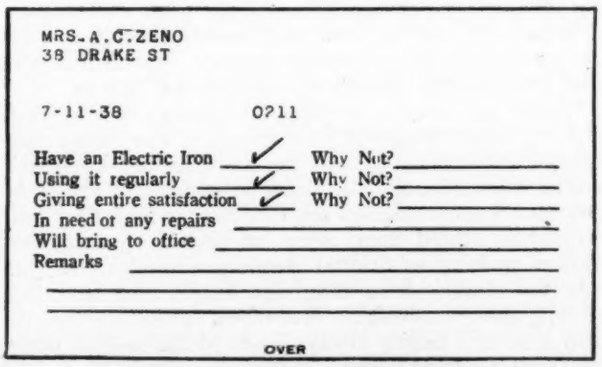
IRON CAMPAIGN BY DAYTON POWER & LIGHT CO. PROVES SUCCESSFUL.

Co-operation with Dealers and Canvassing Methods Mark Merchandising Campaign in Dayton.

The electric flatiron—often called the "glad iron"—is one of the most popular electrical devices with the women folk at home. It is also well at the top of the list when it comes to the load-factor of the various individual electrical appliances, being used oftener and longer than most current-consuming devices. Flatiron campaigns are inaugurated by central stations for the above reasons; the flatiron is a good and easy seller, and, when sold, it is a very satisfactory consumer of current.

When the Dayton Power & Light Co. launched a flatiron campaign in Dayton and some of the surrounding settlements it expected to obtain good results. But it accomplished a great deal more than it had hoped. The campaign lasted one month, of thirty-one days, and was launched at a time when conditions were in favor of success.

At the commencement, and just previously, the company carried on a certain amount of advertising, but comparatively little, stating what it was to do. At the same time the company's high school students' co-operative school was started, by which high school students made a house-to-house canvass for the sale of flatirons. The accompanying illustrations show the form of card employed by these students when


MRS. A. C. ZENO
38 DRAKE ST

7-11-38 0?11

Have an Electric Iron ✓ Why Not?
Using it regularly ✓ Why Not?
Giving entire satisfaction ✓ Why Not?
In need of any repairs
Will bring to office
Remarks

OVER

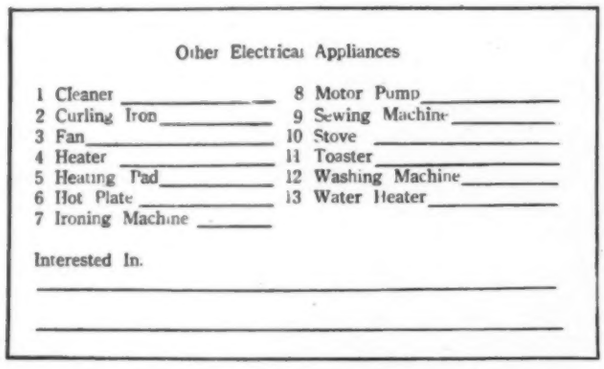
Fig. 1.—Front Side of Card Distributed by Dayton Power & Light Co., During Flatiron Campaign.

canvassing from house to house. For the campaign the Dayton company sold a G. E. iron for full retail price of $6.50, giving also as a premium a Rid-Jid folding ironing board. The terms called for a deposit of 50 cents when the customer made the contract and

got the iron, and thereafter $1 per month, payable at the time when the electric light bill was paid.

The population of Dayton is about 165,000, and the number of flatirons sold amounted to 1206. In Wilmington, a nearby settlement of 500 persons, 145 irons were sold; in Piqua, with a population of 15,000, some 130 irons were sold, while Xenia with 10,000 persons absorbed 100 irons. During the campaign, and because of it, the company found that there were more than 300 irons that had been sold at different times to customers but were not being used, because they were in need of some small repair such as broken cord, broken terminal clips or open circuit. About the same proportion of defective irons were collected from outlying settlements. These irons were taken up, removed to the repair shop of the company where they were repaired and returned to their respective owners ready for work. The result was that approximately 1500 electric irons were made active consumers of current, 300 being irons that had previously done little toward load building, hence were of as little use to their owners as to the utility.

During the campaign, the Dayton Power & Light Co. found that many of its customers were interested in many electrical appliances other than flatirons, or


Other Electrical Appliances

1 Cleaner _____ 8 Motor Pump _____
2 Curling Iron _____ 9 Sewing Machine _____
3 Fan _____ 10 Stove _____
4 Heater _____ 11 Toaster _____
5 Heating Pad _____ 12 Washing Machine _____
6 Hot Plate _____ 13 Water Heater _____
7 Ironing Machine _____

Interested In.

_____

_____

Fig. 2.—Reverse Side of Card Distributed During Flatiron Campaign.

in addition to them. In cases of this kind the company notified electrical dealers and contractors throughout the city. In this way the names of more than one hundred prospective purchasers of electric washing machines, vacuum cleaners, toasters, etc., were brought to the attention of the local contractors. It is policies such as this that breeds friendliness on the part of electrical dealers toward the central station, resulting in reciprocity and general benefit.

After the above-mentioned campaign had closed, and the results obtained determined, it was found that in practically every case of the one hundred interested parties whose names had been forwarded to the dealers, each had purchased the device in which they had previously stated they were interested, in some instances making additional purchases besides. In this way the electric iron campaign might also be called an appliance campaign. But then, when an electric iron is sold it nearly always leads to the sale of other electrical appliances too.

PRECIPITATION OF TAR FOG BY ELECTRICITY PROVES SUCCESSFUL.

According to a communication presented by G. Davidson to the Canadian Mining Institute, the Cottrell process of electrical precipitation is able to deal with the crude gases produced in the distillation of coal, wood and petroleum, even at the high temperature used in modern industrial processes, while the usual methods of tar fog removal in extractors require cooling of the gases. Cleaner distillates were obtained with electric precipitation. The treater chamber used consisted of an iron pipe, 15 ft. high and 12 in. in diameter, provided with fused quartz insulators; approximately a million cubic feet of gas was passed through the heater per day, and the heater required about 2.5 hp. or 3 hp.

STORE AND INDUSTRIAL LIGHTING CAMPAIGNS SUCCESSFUL.

University of Ohio Establishes Educational Course on Industrial Lighting Practice.

Reports from several central-station companies indicate that in a number of cities "better store lighting" campaigns are meeting with excellent results. Storekeepers and owners of establishments having large interiors have been found readily responsive to the advantages of skillfully planned artificial lighting arrangements. It is likely that considerable time will be devoted this winter to the subject, which is made interesting by many improvements completed in lighting practice and in the essential equipment for it by the laboratory and research departments of the large electrical manufacturing concerns.

The Ohio State University, recognizing the practical importance of this phase of central-station service, has established, through its electrical department, a course of 12 lessons on industrial lighting practice. In this course the essential fundamental principles are taught and the best established practice is described, partly through the medium of trade literature and technical bulletins of the lighting equipment manufacturers. The application is illustrated through practical problems, in such a way as to give the student a definite conception of the best methods of treating lighting problems.

JAPANESE CENTRAL STATION INSTALLS TWO LARGE TURBINE UNITS.

Two 25,000-kw. steam-driven turbine units of Westinghouse make, which will complete the largest steam-driven electrical installation in the Far East, are now being erected at Osaka, Japan, for the Osaka Electric Light Co.

Located in an extensive industrial district, this company furnishes light and power to street railways, steel works, shipbuilders, copper-refining plants, paper mills, electrochemical installations and other industries.

It is noteworthy that in 1908 the Osaka company installed three steam turbine units of 3000 kw. each. In 1910 two more units of like capacity were added, and in 1911 two 5000-kw. units. The 25,000-kw. units now being installed will bring the capacity of this plant up to 100,000 hp.

SECTION MEETINGS OF IRON AND STEEL ELECTRICAL ENGINEERS.

The Association of Iron and Steel Electrical Engineers will hold the following section meetings: Pittsburgh, Oct. 25, Chatham Hotel, review and discussion of papers at the recent St. Louis convention; Philadelphia, Nov. 1, Engineers' Club, paper on "Electrical Cleaning of Gases as Applied to the Blast Furnace," by N. H. Gellert and K. V. Laird.

Operating Practice

Special Line Structures—Peculiar Transformer Trouble —Electric Furnace Leads—Mercury Arc Rectifier Tubes

SPECIAL LINE CONSTRUCTION FOR LONG SPANS AND RUGGED COUNTRY.

Pole Setting Adopted by Western States Gas & Electric Co. Proves of Long Life.

Around Eureka, Calif., the Western States Gas & Electric Co. is employing a very interesting form of pole setting for carrying its high-tension transmission lines over mountain ranges and rough country. In building the line in question, and at the time the construction was carried out, it was impossible to secure anything except native timber, redwood. As native timber planted in the ground would completely rot out at the ground line in about three years the company adopted the form of pole setting shown in the accompanying illustration.

Double-Pole Setting That Overcomes Pole Rot and Handles Long Spans Conveniently.

At first a line about one mile was erected, there being two poles set on top of the ground and guyed four ways, as shown. No part of the pole enters the ground, the base of the pole being given sufficient foundation to prevent this even under weight. The form of construction shown has been in vogue now for ten years and to date absolutely no trouble has occurred; it has not even been necessary to tighten any of the guy wires. As it became necessary to reconstruct old lines, this same form of construction has been followed.

The Western States Gas & Electric Co. states that the cost of the two-pole structures is about two and one-half times as much as a single-pole structure. On the other hand, as the spans range from 150 ft. to as high as 3600 ft., with an average of probably 600 ft., this form of construction has been found cheaper than a single-pole installation built for 650-ft. spans. Much of the country traversed is most rugged, passing over several mountain ranges, and the company recommends the above form of construction for this class of work.

RESIDUAL MAGNETISM CAUSE OF UNCOMMON STARTING TROUBLE.

Saturation of Magnetic Circuit Causes Current Rush in Starting 2000-Kw. Synchronous Converter.

By F. B. Johnson.

A 2000-kw. synchronous converter for supplying railway load was connected to a bank of three 750-kv-a. transformers. It was the custom to always start this machine from the alternating-current end by means of one-third and two-thirds starting taps on the transformers. In attempting to start this machine one day a peculiar trouble developed. The primary oil circuit-breaker of the transformers was closed with the starting switch in the customary one-third tap position. The machine did not start up, however, as the relays on the high-voltage side of the transformer bank operated and opened the circuit-breaker.

The alternating-current starting switch was opened and the oil circuit-breaker closed and opened four times. On the first trial the overload relay in one phase of the transformer bank operated, and on the second and third occasions the overload relay on another phase operated, in the second case opening the oil circuit-breaker. On the fourth trial the relays did not operate. The starting switches were then closed and the machine started up and shut down several times, the alternating-current and field break-up switches always being left closed until the machine had come to rest.

The following explanation solves the above-mentioned trouble and is undoubtedly the correct explanation. When the oil circuit-breaker controlling the transformers is opened, the circuit is usually broken at the zero value of the current wave. Because of its retentivity, the iron remains magnetized to some value, which may be as high as 70% of the normal. When the transformer oil circuit-breaker is again closed, the current in part of the first cycle may tend to magnetize the iron in the same direction as that in which it is already magnetized; or it may magnetize it in the opposite direction, depending upon the point of the current wave at which the circuit is closed. When the former occurs, saturation of the iron results, and a current that may be several hundred per cent of the normal value flows. This is the condition that caused the repeated operation of the overload relays above referred to every time the circuit to the transformers was closed.

As to the method of prevention, when the load

has been taken off a synchronous converter if the equalizer switch is opened (where converters are operating in parallel) before the oil circuit-breaker controlling the transformer bank is opened, while the alternating-current running knife switches and the field break-up switches are left closed until the machine comes to rest after the circuit-breaker has been opened, the residual magnetism in the cores of the transformers may be reduced to a very low value. This procedure allows gradual diminishing voltages to be generated in the armature of the synchronous converter, hence the magnetization of the transformer cores to die down. Following the above procedure in shutting down large synchronous converters will enable starting difficulties due to residual magnetism as described above to be eliminated.

EFFECT OF CONDUCTOR ARRANGEMENTS UPON INPUT TO ELECTRIC FURNACE.

Shortening of Conductors Necessitating Rearrangement of Furnaces Increases Input from 1500 Kw. to 2500 Kw.

Every operator of the electric furnace is familiar with the effect of low power-factor and the part played by conductor arrangements in holding back energy input to a furnace, hence rate of melting. The effect of inductance is specially marked on 60-cycle

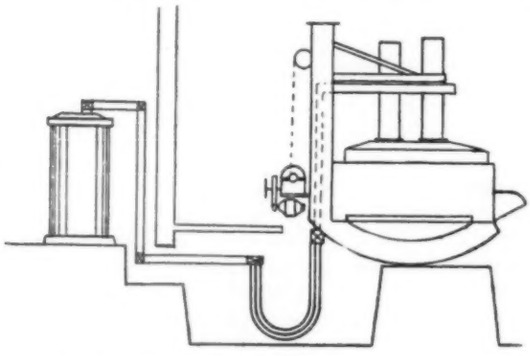


Fig. 1.—Arrangement of Conductors That Limited Input to 1500 Kw.

circuits, so much so that in some quarters 25 cycles is advocated for the very large furnaces.

In one recent instance, as brought out in the report of the Electric Furnace Committee, A. I. & S. E. E., a 15-ton electric furnace obtained its supply through 3000 kv-a. of transformer capacity. The arrangement of transformers, furnace and conductors was as shown in Fig. 1. With this layout it was found impossible to get more than 1500 kw. into the furnace because of heating in the conductors. The power-factors were also extremely low. As the limitation to power input was obviously due to the heating and voltage drop resulting from the conductor arrangement, it was decided to modify the existing arrangement.

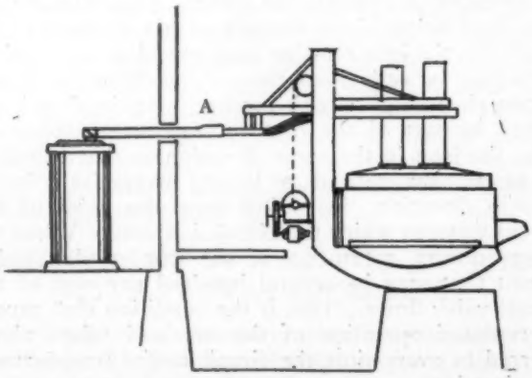


Fig. 2.—Arrangement of Conductors That Enabled Input of 2500 Kw. to be Obtained With Improved Power-Factor.

The furnace was rebuilt to reduce heating troubles in the furnace itself. The conductors were re-arranged as shown in Fig. 2, thereby reducing their over-all length very materially. At "A" a special form of disconnect switch was installed by which conductor length was still further reduced, since the length of flexible conductor ordinarily required when the furnace was tilted was no longer needed. With the arrangement shown in Fig. 2 it was found possible to secure an input to the furnace of 2500 kw. while the power-factor, voltage regulation and efficiency were all materially improved.

VARIATION IN LIFE OF RECTIFIER TUBES INDEX OF OPERATING AND CIRCUIT CONDITIONS.

Experiences of Southern California Edison Co. With Tubes for 2275 Magnetite Arc Lamps.

The question is frequently asked as to what may be considered as being the average life of mercury arc rectifier tubes. It seems to be the general experience that the life of mercury arc rectifier tubes varies quite widely, the causes being partly that the same care is not always given different tubes differently located; all tubes are not, perhaps, of the same quality, and the different classes of service and condition of circuits have different effects upon tube life.

During the year ending July 1, 1919, the Southern California Edison Co. states that the average life of tubes used for supplying its magnetite series street lighting system was 754 hours. There were 2275 series magnetite lamps altogether in service during the year on the company's various street lighting circuits and on this basis the average cost of rectifier tubes for the year was $3.29 per lamp.

The company has found that there is a very wide discrepancy as to tube life in different substations, which means, of course, that the average cost per lamp per year chargeable to deterioration of arc rectifier tubes also varies widely. The average life of tubes obtained in different substations or districts ranged all the way from 205 hours to 1852 hours. This great variation indicates that it pays to give mercury arc rectifier apparatus careful attention and that the circuits should be kept as free as possible from grounds and other causes of surges and wide current fluctuations.

WIRELESS TELEPHONES FOR GEORGIA RAILWAY & POWER CO.

Plans have been made by the Georgia Railway and Power Co. by which communication between their power plants, between substations and power plants and along their transmission lines can be carried on by wireless telephony. The company operates a very extensive transmission system employing high voltage, and the use of the wireless telephone will eliminate those forms of trouble that usually occur when a transmission line is in trouble, and that make the telephone inoperative when most needed. It is proposed that some of the patrolmen's trucks be also equipped with wireless, to facilitate communication and location of trouble.

Contractor-Dealer

Sterling Electric Co.'s Sales Record—Suggestions for Merchandising Appliances—Novel Washing-Machine Display

SALES GOAL FOR YEAR IS REACHED IN EIGHT MONTHS.

Minneapolis Electrical House Succeeds So Well in Attaining Sales Figure That It Sets New Mark for Year.

One of the methods that has been used to great extent by sales managers, especially those of manufacturers, has been to set a "bogey" on sales over a given period. Each salesman is allotted a certain quota of sales, the whole to make up the bogey that has been set. Of course, the underlying scheme is that the bogey gives the sales department a goal for which to strive and makes an incentive for greater sales results.

It has remained, however, for an electrical concern to have its sales department to strive not only for bogey but increase its efforts to equal what is known in golfing parlance as "par" figures. Beginning Jan. 1 of this year the Sterling Electric Co., Minneapolis, Minn., set a bogey of $1,000,000 for its sales during 1919, and used in this connection the motto, "We are growing as you have seen, until our goal is $1,000,000 for 1919."

Believing that it would be necessary to extend its efforts to reach this goal, the sales department endeavored to get ahead of the monthly quota and keep ahead. These efforts were so well directed and gained so much momentum that it became apparent in the six months' period that bogey for the year would be reached away ahead of time. Then came the incentive to see how soon this would be accomplished, with the result of a little less than eight months' time. This was followed by setting a new or "par" figure of $1,500,000 for the year and changing the slogan to "For 1919 we've already put that $1,000,000 through, so we've raised the goal to $1,500,000 to do."

In recognition of the successful efforts in reaching bogey figures the company gave what it called a "Million Dollar Party" to its 230 employes, providing the entertainment for the occasion. The company announced its success in advertisements in the daily newspapers, and in a personal letter to its customers thanked them for their help in making such a showing possible. The letter read as follows:

> Mr. John Brown, City.
>
> Dear Sir: Believing in the prosperity of the great Northwest, we set out to do $1,000,000 business for 1919.
>
> We are pleased to announce that in just eight months we have gone over the top.
>
> We have now raised the goal to $1,500,000 for the year.
>
> Without your past co-operation we would not have reached our $1,000,000 mark. Without your future co-operation we will not attain the $1,500,000 goal.
>
> We, therefore, thank you for the part you have played in our past success. We trust that our future service will warrant your patronage.
>
> With your co-operation we can announce at the end of the business year that the $1,500,000 has been reached.
>
> In exchange for your support we offer "Service and Satisfaction with Every Transaction."
>
> Yours for Success,
>
> STERLING ELECTRIC CO.,
>
> W. H. Vilett, President.

Setting a bogey and reaching it are two different things. But the enthusiasm generated by the company enabled its employes to attain the original goal so easily that there hardly remains any doubt but that the new goal will be reached.

BOSTON CONTRACTORS AND DEALERS MEET.

The Boston district of the Massachusetts State Association of Electrical Contractors and Dealers held a meeting Oct. 16 at the City Club, Boston, at which George H. Guest, manager of the electrical appliance department of Bryan & Marsh Co., Boston, and C. E. Greenwood of the Boston Edison Company were the principal speakers.

"Million Dollar Party" Given by Sterling Electric Co., Minneapolis, Minn., to Its Employes After Sales Goal of $1,000,000 for 1919 Was Reached in Less Than Eight Months.

Merchandising Suggestions for the Electrical Dealer

Advantage of Featuring Single Articles in Window Display—Fearing Department-Store Competition—Making Preparation for Christmas Trade—Planning the Sales of Electrical Appliances as Holiday Gifts

THERE is a tendency among dealers to make their window displays appear flat by showing a large number of articles at the same time. This is only natural, because the major portion of the line consists of small devices. Unless a good-sized article, such as a washing machine or a range, is featured, it doesn't seem logical to devote the entire display space to one, or even two, articles, and the dealer is tempted to show samples of everything he sells so those who stop to look at his display won't miss anything. The nature of the dealer's business may demand just this sort of thing, but as a general rule it is better to have displays concentrated on a single article or not more than two or three closely associated articles. The reason is that the mixed display is not so apt to leave a distinct impression on the onlooker's mind as a featured display.

A good example of this principle is given by the accompanying illustration, which shows a window display by the Commonwealth Edison Co.'s Adams street electric shop, Chicago. If window displays were given titles this one would be called "Autumn—and Electrical Appliances" because there is a suggestion of autumn in the whole display. This effect is secured partly by the basket of seasonal flowers but mostly by the colorings of the background and furnishings. Rich, light brown draperies and lamp shades are contrasted with the dark brown upholstered furniture, the blending of colors giving unmistakably an autumnal tone.

In such a setting the use of the vacuum cleaner is forcibly suggested for fall cleaning; likewise the use of an electric radiator for tempering the chilly mornings that come this time of year.

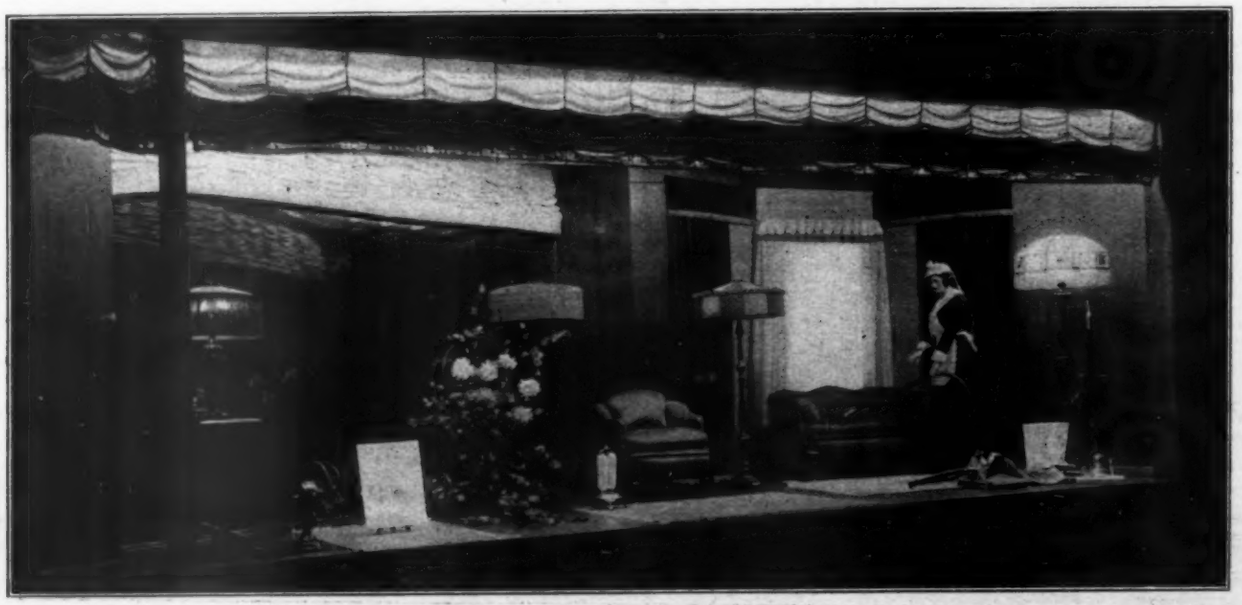
This display is another good testimonial to the fact that featuring an article or two against a suitable background is better than cluttering window space with a lot of devices, no one of which attracts particular attention.

Fearing Department-Store Competition.

Not long ago the writer was talking to an electrical contractor and dealer who happened to be in a pessimistic mood. Chief among his burdensome troubles was an ingrown fear that the department stores were going to corral all the business in electrical appliances and that competing electrical dealers would eventually have to close up shop. His attitude was partly due to the fact that his store was on a side street, a block away from the heavy traffic of the main shopping thoroughfare, and the crowds that didn't pass his door made him feel, particularly on gloomy days, that he didn't have much chance to get business. He figured that the crowds would never come his way, and as long as his contracting business paid pretty well he would be content to take what appliance business he got and rail away at the department stores for taking what he didn't get.

On entering the store we noted that the window display space was devoid of everything but a few lamp cartons, two small motors and several flashlights. The interior of the store was poorly lighted and there was a confusion of show cases, tables, shelving and desks that would nearly baffle any customer trying to make a purchase.

It is hardly believable that such a poor merchant could have the temerity to criticize others, but we

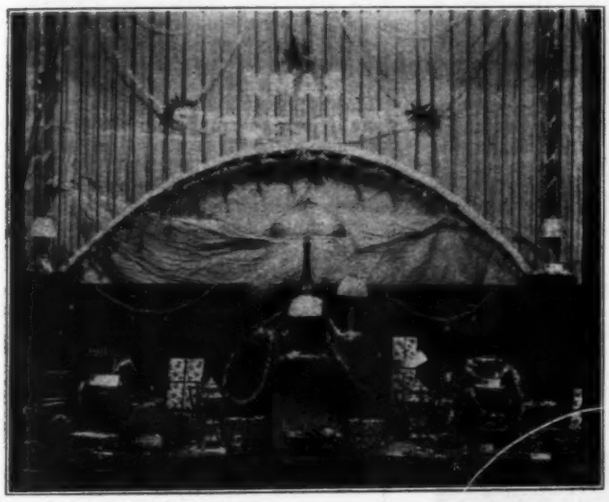


Display in Commonwealth Edison Co. Electric Shop Illustrating Principle of Featuring Small Number of Closely Associated Articles at Same Time.

suppose it was because he was envious of those who were more progressive. Fortunately the number of dealers of this kind is growing less every year, and of course there is a correspondingly smaller number who think they have anything to fear about the competition of the department stores.

Preparing for Christmas Trade.

About 75 per cent of holiday shopping is done in the two weeks preceding Christmas; and this is in



Now Is the Time to Begin Planning Christmas Displays—This One Was Made to Catch the Eyes of Those Who Didn't Know What Kind of Presents to Give.

spite of all the efforts made to have the public do its Christmas shopping early. The condition is one that probably always will exist, and is one that greatly concerns the electrical dealer in his plans for Christmas trade.

It generally works out this way: The dealer puts in a stock or orders enough ahead so that he believes he can easily take care of his trade for the season. During November and the early part of December sales will increase, but they do not feel the impetus of Christmas buying. Then sales come on with a rush, the dealer's shelves are cleared of this and that article, and customers are disappointed or are compelled to buy substitutes. This story has been repeated year after year with little variation, much to the detriment of dealers who are slow to admit that too conservative a buying policy is wrong. It is a detriment to the whole industry as well.

When a dealer's stock is pretty well sold out, of course he must feel some satisfaction in having a good season. But it is also an indication that advantage has not been taken of all the sales possibilities.

The solution of the problem is for dealers to do what they advise the public: "Do your Christmas buying early." A large stock of staple electrical appliances suitable for gifts is bound to make any dealer look to turnover and devise plans for producing sales during the early part of the Christmas shopping season. Timely window displays, newspaper advertisements, gift suggestion booklets and circular letters to prospective customers are methods that can be used to make November an intensive selling period as well as December.

Successful merchants in other lines do most of their buying six months ahead of season and quite a large portion of their stocks is carried over from season to season. It would seem that the electrical merchant could afford to do his buying at longer range, especially because most electrical articles are saleable the year around. But if dealers do not find it possible to do their buying for holiday trade six months ahead of time, at any rate they should see the error in having a hand-to-mouth policy regarding buying and selling Christmas goods. Then trade conditions will be relieved for them as well as the jobbers and manufacturers.

Last year a certain electrical dealer worked out a gift suggestion plan that brought very satisfactory results. In October he started the preparation of a booklet giving a complete list of suggestions for holidays gifts. Such work usually takes two to four weeks, so that he had them ready for distribution the middle of November. This dealer didn't attempt to secure a list of prospective customers, but mailed one of the booklets to his regular list of patrons. His theory was that any customer pleased with an electrical device he was using would be likely to purchase or recommend it or one of the other suggested articles for gift purposes.

Newspaper advertisements featuring electrical gift suggestions were a part of the plan. These were linked with appropriate window displays.

Working out this plan took quite a bit of thought and effort, but a comparison of the season's sales with those of the preceding year showed such a large increase that the plan is being tried again this year.

NOVEL WINDOW DISPLAY SELLS MANY ELECTRIC WASHERS.

Cleanliness is associated with the electric washing machine, and with this idea in mind the Electric Sales & Construction Co. of Cleveland recently had a window that fairly shone with cleanliness and light. The floor was of blue crepe paper with a deep border of white. Screens of brown stood in the background, in front

Washing Machine Display Which Brought Out the Idea of Cleanliness in Connection with Washers.

of each being a graceful palm. In the center was a washing machine, behind which was a mirror tilted at an angle so that from the outside of the window the operation of the machine might be observed. Several poles were twined with blue crepe paper, flaring out into a fan-shaped arrangement at the top, while strips of blue paper ran from one to another. Fastened to each pole was a neat card of grey, lettered in blue and white, which told of the advantageous points of the machine.

New Appliances

Unique Features in New Push-Button—Controlled Starting Switch for A. C. Motors and in Swiveling Attachment Plug

Alternating-Current Motor-Starting Switch Operated by Push Button.

It is permissible to start induction motors up to and including 5 hp., and in some localities up to and including 7½ hp., by merely connecting the motor to the power circuit. Small induction motors can be started under these conditions without injury.

In the past it has been customary to start these motors by simply closing a knife switch, or switch similar to a knife switch. For those who wanted something better, it was possible to buy a switch which would short-circuit the fuses while the motor was starting, and then after the motor had come up to speed, the operator could make a second motion with the starting switch that would insert the fuses in the motor circuit to be used while it was running.

Fig. 1.—New A.-C. Starting Switch With Box Closed.

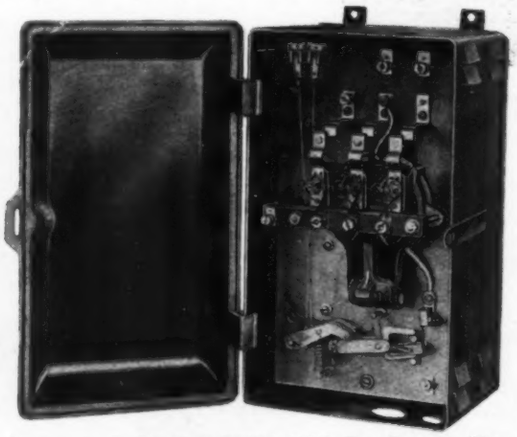


Fig. 2.—A.-C. Starting Switch With Box Open to Show General Construction and Overload Protection.

A new device for this kind of work has just been developed by the Electric Controller & Manufacturing Co., Cleveland, Ohio, to make the starting of these motors foolproof. It is known as the "A. C. Starting Switch," and is operated by a push button. It is inclosed in a steel box as shown in Fig. No. 1, with conduit connection for all wires. A neat, compact push button arranged for conduit connection, as shown in Fig. 3, is supplied, for starting and stopping the motor. Fig. 2 shows the starting switch with the cover of its box open.

Fig. 3.—Push Buttons for Operating the Switch.

Particular attention is called by the manufacturer to the two wires extending the length of the slate on the left-hand side. These wires give overload protection of the inverse-time-element type, both while the motor is starting and while it is running. The principle used is one entirely new in motor-starting practice. These two wires are stretched and the operating value of this overload protection is adjustable by changing the tension of the wire. If too much current is being taken by the motor, these wires will expand, causing the small contact at the bottom to open and this will in turn de-energize the magnet coil and cut the motor off the power line. It is then necessary to push the start button before the motor can again be started. This same principle is used in ammeters and gives an extremely accurate overload protection, at the same time giving the inverse-time-element feature.

There are no laminations used in any part of this alternating-current starting switch. It is only necessary to push the start button to start the motor, and it is only necessary to push the stop button to stop the motor.

New Cutler-Hammer Swivel Plug.

A new swivel attachment plug has been developed in the specialty department of the Cutler-Hammer Manufacturing Co., Milwaukee, Wis. The design of this new plug is such that several distinct advantages are provided. It is shipped completely assembled and need not be taken apart in order to wire. The work of attaching these plugs is further reduced because there are no binding screws to loosen and untighten. In fact, no screws are used in the construction.

The accompanying illustrations show some of the advantages of the plug and the ease with which the wires may be connected to it. It consists of an inner and outer member which revolve on each other. The wires are connected to the inner member, while the outer member comprises the ordinary screw shell and a knurled head made of heat-proof molded insulation. In wiring, two wires are stripped an equal length, about three-eighths of an inch; one is pushed into a center opening of the inner member and the other through any one of four concentric openings of the same member. By means of a stationary soldering iron, one wire is sweated in the center opening, while the other, after being turned over into a groove on the inner member, is soldered to it. The entire operation, it is claimed, requires much less time than is necessary to wire up any other type of plug, as demonstrated by actual test.

After being attached to a cord there is no possibility of the parts becoming separated when being unscrewed from a socket. This is a very desirable feature when the plug is used under a small shade or where a good grip on the plug cannot be secured. This new plug when shipped to the electric appliance manufacturer, reaches him in one complete piece. It cannot become disassembled nor a portion lost in shipment or in distribution. Trouble and losses due to difference in the number of the component parts on hand are thus avoided.

Two Views of New Swivel Attachment Plug With Quickly and Easily Soldered Connections, Eliminating Binding-Screw Troubles.

Trade Activities

General Electric Leases American Conduit Business—Appleton Electric Extends Manufacturing Facilities—Catalogs

Horace G. Cooke, who has withdrawn from the Connersville Blower Co. after 20 years of service as eastern representative, has announced the organization of Horace G. Cooke, Inc., to engage in designing and marketing a complete line of rotary compressors, gas exhausters, and pumps for the National Marine Engine Works, Inc. The executive and sales offices will be located at 50 East 42nd street, New York City.

Beardslee Chandelier Manufacturing Co., Chicago, is sending a letter to the trade in which is illustrated and described a new and attractive line of portable lamps, and presents to dealers an unusual profit-making opportunity for the fall trade. Owing to fluctuating market conditions and the enormous demand for portables, the company urges that dealers place their orders immediately to insure delivery for the holiday season.

Mechanical Appliance Co., manufacturer of Watson electric motors, with factory and main offices at Milwaukee, Wis., has recently opened up new offices in Buffalo and St. Louis. W. C. Winterroth, formerly connected with the Chicago office, will be located at 318 Prudential building, Buffalo, as district sales manager for western New York. The St. Louis office will be in charge of L. F. Mahler, who has been recently appointed district sales agent for St. Louis and adjacent territory. His office is located at 1039 Syndicate Trust building, St. Louis.

Moran & Hastings Manufacturing Co., 16-18 West Washington boulevard, Chicago, has prepared a new circular which illustrates and briefly describes the "Raymo" adjustable fixture. It is especially adapted to the office, store or factory, and provides a uniform distribution of illumination without glare. It is of excellent construction, pleasing in appearance and has been designed for use with 100, 200 or 300-watt Type C Mazda lamps. This unit has been adopted by many of the country's most prominent industries and has given complete satisfaction wherever installed, according to reports received by the company.

Jackson & Moreland Organize.—Dugald C. Jackson and Edward L. Moreland announce that after their absence in France in the Corps of Engineers, United States Army, they have now resumed their practice as consulting engineers under the firm name of Jackson & Moreland with offices at 387 Washington street, Boston, Mass. They will carry on the practice formerly conducted in association with William B. Jackson under the firm name of D. C. & Wm. B. Jackson. William Jackson has temporarily retired from the firm in order to look after other interests. Associated with the firm is Arthur L. Nelson, who will give particular attention to the design and the supervision of construction of power plants and transmission systems.

Gould Manufacturing Co., Seneca, N. Y., manufacturer of rotary, triplex and centrifugal pumps, has opened a district sales office in Detroit at 804 Dime Bank building. E. B. Gould is in charge.

Multiple Fuse Co., New York, has established a branch office in Cleveland, Ohio. E. C. Newman, who has been appointed district manager of the Cleveland branch, will make his headquarters at 30 Euclid Arcade.

Electric Products Co., Cleveland, Ohio, manufacturer of controllers, switchboards, battery-charging motor generators and rheostats, has opened a branch office in the Dime Bank building, Detroit, Mich., in charge of E. H. Bridge.

General Electric Co., through its Fort Wayne (Ind.) branch, has opened a night school for the benefit of its employes who are working for better wages and promotion. The enrollment is much larger than last year, and the keenest interest is being taken by employes of the Fort Wayne works.

The Norma Co. of America, 1790 Broadway, New York, at a recent meeting of its board of directors, elected O. P. Wilson to the presidency of the company. Mr. Wilson has been assistant manager of this concern for several years. W. M. Nones continues as president and treasurer, in executive charge of the company's affairs.

The American Conduit Manufacturing Co., with general offices anud factory at New Kensington, Pa., announces the leasing of its rigid conduit business to the General Electric Co., who will continue operations at New Kensington by its Sprague Electric Works. Plans are being prepared for the enlargement of the plant and additional equipment will be installed, to the end that the users of American and Galvanite brands of rigid conduit will have the advantage of exceptional service under all conditions. There will be no change in the personnel of this company, but the name will be changed to the American-Wiremold Co., which will concentrate upon the manufacture of Wiremold surface raceway and Wireduct non-metallic tubing, at Hartford, Conn.

H. B. Kirkland, the vice-president of the American Conduit Manufacturing Co., will divide his time between the Sprague Electric Works and the American-Wiremold Co., and will continue to give his personal attention to his old customers. Other officers of the company are D. Hayes Murphy, president, and Guy M. Stewart, secretary. These men have a wide experience in this field, and it is to be expected that with the concentration of their energies upon Wiremold and Wireduct valuable results to the industry will accrue. The former company has established for itself an enviable record and the development of the American-Wiremold Co. at Hartford, Conn., will be watched with considerable interest by all those actively engaged in the industry.

Bailey Meter Co., Cleveland, Ohio, is making distribution of Bulletin No. 30 descriptive of "Fluid Meters for Low Pressure Gas and Air," which points out in a clear and concise manner the advantages of this product. It describes in detail the numerous parts entering into the construction of the Type C10 meter and deals at length with the principles of operation. The text is accompanied with excellent illustrations, including both halftones and line drawings. Four pages of the bulletin are devoted to chart records of Bailey fluid meter installations and partial list of users given, indicative of the wide range of industries which has adopted this type of meter and found it to give complete satisfaction. These meters have been developed and perfected during the past ten years and are particularly adapted to the many and varied needs of modern power plants, gas works, steel mills, chemical works, and in fact all large producers of users of power. In addition to this line, the Bailey company manufactures many other types of meters, including fluid meters, for recording and integrating the flow of steam to turbines, engines, heating systems, low pressure steam, exhaust, etc.; boiler meters, weir meters and radiimeters.

The Electrical Alloy Co., Morristown, N. J., manufacturer of high-grade resistance wire and strips, is sending out a folder relative to its nickel and nickel alloy wire and strips. The company has manufactured these materials exclusively for many years and has established for itself a world-wide reputation. The pamphlet briefly describes its resistance material among which are included electrical alloy calido, electrical alloy rayo, electrical alloy comet, electrical alloy phenix, electrical alloy ideal, electrical alloy lucero, electrical alloy magno spark point nickel, electrical alloy pure nickel and grade "A" Monel metal, and illustrates a few of the articles which contain this wire. The company maintains an export department pro-

vided with every facility for promptly despatching ocean shipments to its customers abroad, and a staff of electrical and metallurgical engineers which is capable of assisting the manufacturer in developing his apparatus or to solve any resistance problem with which he may have to contend. The products of the Electrical Alloy Co. have been adopted as a standard specification by many of the largest American companies, the following being perhaps the most representative; General Electric Co.; Edison Electric Appliance Co.; Westinghouse Electric & Manufacturing Co.; Western Electric Co.; Taylor Instrument Co.; General Motors Co., and the Champion Spark Plug Co. The company has now available for distribution the new edition of its bulletin catalog, a copy of which will be furnished upon request.

Appleton Electric Co., Chicago, Ill., manufacturer of conduit fittings, in order that it may adequately meet the large demand for its products, has now under course of construction a new plant, which it is claimed will double its present capacity and result in greatly increased production. The main building, which will be L shaped, is to be a four-story and basement structure covering an area of over 45,000 cq. ft. A building to care for the press room will also be erected. In addition, the company will erect a power house, which will provide 140,000 ft. of floor space. The new plant will be modern in every respect and will be equipped with new and up-to-date machinery. It will be located at Paulina and Wellington streets, with a switch track from the Chicago & Northwestern railroad, affording excellent shipping facilities. The products of the Appleton company are meeting with increasing popularity and the erection of this large plant may be regarded as indicative of the company's optimistic view of the future. A. I. Appleton is president and treasurer of the company; F. H. Merrill, vice-president, and J. V. Painter, secretary, and under their leadership marked progress has been made. Branch offices are maintained by the Appleton Electric Co. in New York City and San Francisco.

Harvey Hubbell, Inc., Bridgeport, Conn., has issued a new catalog of Hubbell reflectors for industrial plant lighting. This catalog carries out the unique scheme inaugurated by this firm nearly two years ago of listing the various sizes and types of reflectors and accessories in systematically arranged columns and rows. At the top of the page are shown the different sizes and types of reflectors with their corresponding distribution curves. In the left column are shown various types of screw collar holders, brass clamp holders, keyless porcelain sockets, extensions, etc. By following the horizontal row to any vertical column there is found an illustration of each particular size and type of reflector equipped with the particular holder or other accessory. Eighteen pages are devoted to this very effective pictorial arrangement. A few pages are also devoted to the company's medium base and mogul base porcelain sockets, also half reflectors and parabolic reflectors. These various reflectors are made with three different types of finish, matte aluminum, porcelain enamel and white paint enamel.

Swiss Mission Visits Westinghouse Plants.—On Friday, Oct. 3, the plants of the Westinghouse Electric & Manufacturing Co., at East Pittsburgh and Wilmerding were honored by a visit from the Swiss Mission for economic studies in North America. This mission is visiting various cities in the United States and Canada, for the purpose of studying American methods and practices, in order that they may apply these methods where practical to their own various lines of business.

The mission was met in Pittsburgh by representatives of the Westinghouse Airbrake Co., and the Westinghouse Electric & Manufacturing Co., and escorted to Wilmerding on special cars attached to one of the regular Pennsylvania railroad trains. Following the reception a trip was taken through the Airbrake Works, where the various processes involved in the manufacture of the airbrake were explained in detail to the visitors, who expressed much interest in the manufacturing methods pursued by the company. After completing the inspection tour, the party was escorted to the Welfare building, where luncheon was served. Immediately following the luncheon A. L. Humphrey of the Airbrake company welcomed the visitors, and turned over the meeting to W. S. Bartholomew, vice-president of the Airbrake company, who extended a further welcome and told of some of the activities of the company in the manufacture of railway equipment. Response was made to these addresses by Commissioner Zweifel of the mission, who expressed his very great appreciation of the reception tendered the mission. He also took occasion to say that the Westinghouse interests need no advertisement, as every man, woman, and child in Switzerland knows Westinghouse from having seen it on the airbrakes which are used on all of the trains in Switzerland. The visitors were then conveyed in special cars to East Pittsburgh. On their arrival in East Pittsburgh, the visitors were met by Acting Vice-President T. P. Gaylord, and other Westinghouse officials, and a number of guides speaking French and German, both of which languages are extensively used in Switzerland. The visitors were then shown through the immense electric and machine works constituting the East Pittsburgh plant. After having completed a tour of the works, the party left for Pittsburgh at 4:40 p. m., having expressed themselves as being particularly delighted with the reception accorded them by the Westinghouse companies. They even went so far as to say that it was the most elaborate reception that had been given them since their arrival in this country.

General View of New Plant of Appleton Electric Co., Chicago, Ill.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Rutland, Vt.—Contract has been awarded to the Western Vermont Power & Light Co. by the New York Consolidated Slate Co. for furnishing additional electric power for the operation of its plant to the amount of about 100 hp., which will include hoists and compressor motors. It is understood that the Consolidated company is planning for the opening of a new quarry for increased operations.

Chicopee, Mass.—Springfield Coach Works has had plans prepared for the erection of a new boiler plant at its works in connection with alterations and improvements to be made in the existing plant. The work will cost about $15,000.

New Britain, Conn.—Landers, Frary & Clark have completed plans for the erection of a six-story factory building, 120x300 ft.

Binghamton, N. Y.—Binghamton Light, Heat & Power Co. has commenced the installation of a new turbine unit at its local plant as well as new condensor equipment.

Binghamton, N. Y.—Johnson City Water Co. is arranging plans for the construction of a new local pumping station to have a capacity of 12,000,000 gal. The pumping equipment will comprise the installation of six 100-hp. capacity motors, electric service for operation to be furnished by the Binghamton Light, Heat & Power Co.

Buffalo, N. Y.—City commission is considering plans for the installation of a new street lighting system in William street. Rapid progress is being made on the installation of new aerial lights in Hertel avenue.

Buffalo, N. Y.—Ericson Manufacturing Co., 1100 Military road, manufacturer of telephones, magnetos, and kindred equipment, has filed notice with the Secretary of State of an increase in its capitalization from $500,000 to $1,200,000, to provide for general business expansion.

New York, N. Y.—United Machine Works, 57 West Third street, will install an electrically driven ice-making plant of 25-ton capacity.

Rome, N. Y.—Rome Wire Co., Railroad street, manufacturer of electrical wires, etc., has had plans prepared for the construction of a new addition to its plant on Railroad avenue. The structure will be one-story and will cost about $30,000. Contract has been awarded to H. C. Beebe, U. C. N. Bank building, Utica.

Annandale, N. J.—Clinton township committee is considering plans for the immediate installation of a new electric street-lighting system throughout the municipality. Electric service will be furnished by the Hunterdon Power & Electric Co., High Bridge.

Dover, N. J.—New Jersey Power & Light Co. has recently commenced the installation of new boiler instruments at its local plant. Rapid progress is being made on the installation of new coal handling equipment and the construction of coal bunkers, to facilitate operations.

Hilton, N. J.—Plans have been completed by H. Boker & Co., New York, for the erection of the proposed power plant, to be constructed in connection with the new local plant of the company to comprise a group of factory buildings. Gilbert C. Higby, 207 Market street, Newark, is architect.

Irvington, N. J.—Irvington Manufacturing Co., 122 Coit street, has had plans prepared for improvements in the boiler plant at its works to facilitate operations.

Jersey City, N. J.—Announcement has been made by Armour & Co., Chicago, that plans are in progress for the construction of the proposed packing plant to be located on a local site comprising two square blocks bounded by Jersey avenue, Monmouth, Seventeenth and Eighteenth streets, advanced some time ago, but deferred due to war conditions. It is said that an appropriation has been made to cover the cost of a large power plant and refrigerating works to be located at Coles and Seventeenth streets, estimated to cost with equipment installation in excess of $1,000,000.

Newark, N. J.—Megaro Electrical Co. has filed notice of organization to operate a general electrical contracting establishment at 11 Clifton ave. T. and C. Megaro, 21 Clifton avenue, and James Megaro, 1131 Broad street, head the company.

Newark, N. J.—Prest-O-Lite Co., Indianapolis, Ind., manufacturer of acetylene tanks, etc., has had plans prepared for the construction of a large new local plant on property recently acquired on Doremus avenue, to comprise a group of about eleven structures. The buildings will include a charging structure, one-story, about 31x351 ft., one-story boiler plant, for works service, about 48x64 ft., as well as main manufacturing building and other structures, the entire project being estimated to cost $140,000.

Newark, N. J.—Board of Freeholders has taken bids for electrical work in connection with the construction of new extensions to nurses' quarters, etc., at the county institution at Overbrook, the low bid being submitted by the Beaver Engineering Co., 59 Mechanic street, Newark, at $14,387. John W. Hooley, 95 Liberty street, New York, submitted the low bid at $26,800 for the installation of new engine and generating equipment at the institution. It is understood that a quantity of new electrically operated laundry equipment will also be required.

New Providence, N. J.—Borough council is arranging for the completion of the installation of new lighting units for the local street lighting system.

Westville, N. J.—Pennsylvania Railroad Co. has had plans prepared for the installation of new boiler equipment at its local power plant. Contract for the construction of the settings has been awarded to Albert Doak, Philadelphia, Pa.

Carlisle, Pa.—J. F. Rogers Co. will erect a one-story power plant, 45x80 ft.

Colfax, Pa.—Duquesne Light Co. is making rapid progress on the construction of the proposed power station at Colfax, to have an initial capacity of about 60,000 kw., which will be increased ultimately to 120,000 kw. It is said that the new station will be one of the largest and most modern in the country.

Easton, Pa.—Pennsylvania Utilities Company has filed notice with the Public Service Commission of the issuance of bonds for $68,500, to be used for general business expansion.

Philadelphia, Pa.—Boyer & Crawford have awarded a contract to the William Steele & Sons Co., 1600 Arch street, for the erection of a new one-story brick engine and boiler plant, about 49x62 ft., at J and Venango streets. The structure, with equipment installation, will cost $40,000.

Philadelphia, Pa.—In connection with the construction of the proposed local buildings by the Sears, Roebuck & Co., Chicago, to be located on the Northeast boulevard, plans have been prepared for the erection of a one-story power house, about 150x183 ft. The other structures will comprise a nine-story brick and concrete warehouse, about 360x442 ft., with two wing extensions, and six-story administration building, about 82x303 ft.

Pittsburgh, Pa.—Fire recently damaged the plant of the Stimple & Ward Co., 518-20 Sandusky street, manufacturer of electrical goods, to the extent of approximately $7000. The company is planning for immediate rebuilding of the destroyed portion.

Pittsburgh, Pa.—Duquesne Light Co. is having plans prepared for the construction of a two-story brick, concrete and steel local substation. Estimated cost $50,000.

Reading, Pa.—Metropolitan Edison Co. has completed arrangements for a bond issue for $96,000, a portion of the proceeds to be used for general business expansion. Notice has been filed with the Public Service Commission.

Sayre, Pa.—Sayre Stamping Co. has recently completed the electrification of its entire plant, the installation comprising about 100 hp. Electric energy for operation is furnished by the Sayre Electric Co.

Wilkes-Barre, Pa.—Wilkes-Barre Light Co. has filed application with the Public Service Commission for a certificate of valuation preliminary to the issuance of bonds for about $1,000,000.

Williamstown, Pa.—Lykens Valley Light & Power Co., operating in upper Dauphin and the western section of Schuylkill counties, has filed notice with the Public Service Commission of an increase in its rates for service. The new schedules also provide for the elimination of the coal clause from contracts as well as the discounts.

Annapolis, Md.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., will erect a power and boiler plant at the local naval academy at a cost of $45,000.

Baltimore, Md. — Samuel T. Williams, 223 North Calvert street, is in the market for a 100 to 200-kv-a. turbine generator, 3-phase, 60-cycle, 2300 volts; one or two 150 to 200-hp. boilers, 135-lb. pressure. Water-tube condenser is preferred for the above unit.

Clearspring, Md.—Clearspring Light & Power Co., recently organized, is planning for the construction of a new electric transmission line from Dam No. 5 on the Potomac river, to Clearspring and Big Spring, with distributing system.

Ware Shoals, S. C.—Ware Shoals Manufacturing Co. will erect an ice plant, 100x125 ft., of 15-ton capacity. It will be of reinforced concrete and standard mill construction. Electrical equipment will also be installed. J. E. Sirrine, Greenville, S. C., architect.

Barwick, Ga.—An election will be held upon issuance of municipal bonds for establishing electric light plant. Address mayor.

Fort Gaines, Ga.—Georgia-Alabama Power Co. has completed negotiations for the purchase of the electric plant of the Cridelle-Fowler Co. It is said that the new owner is considering the enlargement of the plant and the construction of a new dam across Patsual Creek near Cridelle mill, increasing the present capacity to about 1000 hp., as well as make extensions in its transmission system, the entire work being estimated to cost $250,000. Dermott Shemwell is president.

Moore Haven, Fla.—Gladys Telephone Co. will install magneto outfit with 100 instruments.

NORTH CENTRAL STATES.

Barnesville, Ohio—The city contemplates the erection of a power house at the municipal water works.

Fairmount, Ind.—Rigdon Electric Co. has been incorporated by William H. Markle and others to provide light and power for rural districts near Fairmount.

DATES AHEAD.

Illuminating Engineering Society. Annual convention, Chicago, Ill., Oct. 20-23. General secretary, Clarence L. Law, 29 West 39th street, New York City.

Illinois State Electric Association. Annual convention, Chicago, Oct. 22 and 23. Secretary-treasurer, R. V. Prather, Springfield, Ill.

Empire State Gas and Electric Association. Annual meeting, Buffalo, N. Y., Oct. 24. Secretary, Charles H. B. Chapin, 29 West 39th street, New York City.

Jovian Order. Annual convention, Chicago, Nov. 5 and 6. Headquarters, Hotel Sherman. Acting Mercury, Eli C. Bennett, St. Louis, Mo.

American Society of Mechanical Engineers. Annual meeting, New York City, Dec. 2-5. Secretary, Calvin W. Rice, 29 West 39th street, New York City.

Electric Power Club. Meeting, Hot Springs, Va., Dec. 11, 12 and 13. Headquarters, Homestead Hotel. Secretary, C. H. Roth, 1410 West Adams street, Chicago.

National Council of Lighting Fixture Manufacturers. Annual convention, Detroit, Mich., February, 1920. Secretary-treasurer, Charles H. Hofrichter, Cleveland, Ohio.

National Electric Light Association. Annual convention, Pasadena, Cal., May 18-21, 1920. Headquarters, Hotel Huntington. Acting secretary, S. A. Sewall, 29 West 39th street, New York City.

Indianapolis, Ind. — Indianapolis Methodist Hospital will erect nurses' residence to cost $300,000.

Muncie, Ind.—W. E. Wood Co. 1005 Ford building, Detroit, has the general contract to erect a power and assembly building for the Chevrolet Motor Co. Dynamos, motors, and transformers will be purchased.

Portland, Ind.—A petition has been presented to the Public Service Commission for permission to build a new light and power plant and to create a bonded indebtedness against the city in the sum of $120,000 to raise funds to carry out the proposed plans.

Chicago, Ill.—Ed V. Price & Co. will erect a twelve-story building, 100 x200 ft., at the southeast corner of West Jackson boulevard and South Throop street, at an estimated cost of $800,000.

Clinton, Ill.—Plans for the erection of a modern building to house the local telephone company's plant and for the complete reorganization of the system have been submitted the city council.

Elgin, Ill.—At the November election the question of issuing $200,000 municipal light bonds will be submitted to vote. Address city clerk.

Litchfield, Ill.—The council is considering ways and means to secure ornamental electric lighting.

Quincy, Ill.—An ordinance is before the council providing for improving East Main street by electroliers and underground wiring. Address city clerk.

Springfield, Ill.—Nov. 4 the question of issuing $400,000 electric light extension bonds will be submitted to a vote. Address city attorney D. A. Stevens.

Springfield, Ill.—Sangamo Electric Co. will erect an $80,000 addition to its plant at Converse avenue and Eleventh street. The building will be 80x140 ft. and be of brick and steel construction.

Sterling, Ill.—The council has renewed the contract until May 1, 1920, with the Illinois Northern Utilities Co.

Streator, Ill.—Residents on South Monroe street from Main to Bridge streets are desirous of having that block improved by the installation of boulevard lights. Address city clerk.

Urbana, Ill.—Erection of $50,000 McKinley Memorial Hospital has been authorized by the trustees of the University of Illinois.

Urbana, Ill.—The contract for the central lighting system has been awarded to the Freeman Sweet Co. of Chicago on its bid of $34,300. This company has two contracts already signed in Urbana, one of the Green street lighting system and the other for the Southwestern lighting system.

Bay City, Mich.—Hanson-Ward Veneer Co. has purchased a building to be equipped with additional machinery which will be operated by electricity. F. B. Ward is president of the company.

Detroit, Mich.—Architect G. W. Geares, 41 John Rush street, has prepared plans and will let contracts for a $15,000 power house to be erected by the General Aluminum & Brass Manufacturing Co. The building will be of brick construction, steam heating, plumbing, to be equipped with power house equipment.

Kalamazoo, Mich. — Engineers Woodmansee & Davidson, 208 South La Salle street, Chicago, have prepared plans for $200,000 electric light plant to be erected by the city. Address A. Leuderenk, City Hall, Kalamazoo, Mich.

Saginaw, Mich.—W. E. Wood Co., 1805 Ford building, Detroit, Mich., has the general contract to erect an $800,000 power building and gear grinding building for the Chevrolet Motor Co. Power house equipment, generators, switchboard, etc., will be purchased. Address C. M. Bigale, president, Flint, Mich.

Hartford, Wis.—Plans are in progress for a city power plant costing $60,000. Architects Cahill & Douglas, Gross building, Milwaukee, have prepared plans.

Oshkosh, Wis.—Oshkosh Gas Light Co. recently entered into a contract with the county to supply light and power to the county home, asylum and sanitorium at Winnebago, which will permit of farmers along the line having electric service. The company is also planning to extend its lines to the rural districts.

Osseo, Wis.—The city council contemplates the purchase of the local electric light plant and the installation of a waterworks system. Address J. W. Smith, city clerk.

Racine, Wis.—The city is planning

an expenditure of $500,000 for enlarging the waterworks plant.

Murdock, Minn.—City council has petitioned to build an electric light plant. Bonds will probably be issued. J. F. Ashbaugh, clerk.

Cedar Rapids, Iowa—An improvement that will cost approximately $40,000 will be the building of an addition to C. R. I. & P. railroad boiler house in this city and the installing of two additional power boilers. Joseph E. Nelson & Sons, Chicago, have the contract and some of the material is now on the ground to start work immediately.

Cameron, Mo.—A number of new motors have been installed and others are to be installed soon at the Cameron electric plant.

Greenfield, Mo.—Colin K. Lee and Jay R. Lee, both of Kansas City, Mo., have purchased a controlling interest in the Greenfield Electric Light Co. and are planning extensive improvements to the plant, including the installation of oil engines, the maintenance of 24-hour service and the extension of lines to other towns in the territory.

Rocheport, Mo.—An electric light plant and a white way are to be installed.

St. Louis, Mo.—Additions to the plant of the Union Electric Light & Power Co., estimated to cost in excess of $7,000,000 will be started next spring to keep pace with the industrial growth of St. Louis and the expansion of the city. Sites for additional power plants are now being surveyed and an announcement of the locations of the buildings will be made as soon as they are decided upon. The contemplated extensions will have an initial capacity of 60,000 kw. a day, with provision for an ultimate output of 100,000 kw. The new plant is expected to provide for the needs of the next five years.

Wellsville, Mo.—Mexico Light & Power Co. has purchased the electric plant here. The Mexico plant will transmit power to Wellsville over a line now under construction.

Arkansas City, Kans.—An election is contemplated to vote bonds for a municipal electric light plant.

St. Francis, Kans.—The council has accepted plans prepared by the Hennington Engineering Co., for an electric light plant. Estimated cost, $50,000.

Kansas City, Kans.—The Kansas City commissioners awarded a contract for the installation of ornamental lights at a cost of $43,988.

Guide Rock, Neb.—Bond issue of $12,000 carried at election for electric lights. Address town clerk.

Mullen, Neb.—The city contemplates bond issues for an electric light system. Address town clerk.

Venango, Neb.—Plans and specifications for a light and water system for Venango have been completed by the Hennesey Engineering Co., Omaha.

Herrick, S. D.—The issuance of bonds for the purchase of the private electric light plant to be converted into a municipal system was authorized at a recent election. New machinery and other equipment will be added.

Carson, N. D.—Election will be held soon to vote on bonds for installing municipal light plant. Address town clerk.

SOUTH CENTRAL STATES.

Benton, Ky.—Electric light bonds have been authorized by vote.

McKenzie, Tenn.—The city will improve and extend its light and water systems. Bonds in the sum of $10,000 have been voted. Address the mayor.

Pascagoula, Miss. — Pascagoula Street Railway & Power Co. will rehabilitate the light and water plant.

Lake Charles, La.—Lake Charles Implement Co., recently chartered. will erect a two-story, fireproof building, 80x80 ft. and will install an electric elevator.

New Orleans, La.—New Orleans Railway & Light Co. is understood to be considering plans for the installation of a new cable system across the local river, estimated to cost $10,000.

Wilmar, Ark.—Arrangements are being made by D. C. Smith for the installation of an electric light and power plant in Wilmar. Electric street lights will be maintained by the town.

Fargo, Okla.—The city contemplates the installation of a water and electric light plant to cost $26,000. Address the mayor.

Enid, Okla.—Enid Pipe Line Co. is planning for the construction of a new electric power plant at its works.

Hooker, Okla.—City commission is arranging plans for the installation of a new electric light plant, to be used for municipal service. Estimated cost, $40,000.

Jenks, Okla.—Oklahoma Gas & Electric Co. is considering the construction of a large new electric generating station on the Arkansas river, to cost in excess of $1,500,000.

Miami, Okla.—The council is preparing to install an ornamental lighting system. Address mayor.

Albany, Tex.—The city proposes to install an ice and electric light plant. Address the mayor.

Fort Worth, Tex.—Dallard-Martin Electric Co. has been granted a permit for the erection of a new building at Macon and North streets to cost $100,000.

Fort Worth, Tex.—Permit has been granted for the improvement of the Texas Power & Light Co., to cost $135,000. A new boiler room is included in other improvements.

Huntsville, Tex.—Huntsville Cotton Oil Co. has purchased the plant and franchise of the Huntsville Electric Light & Power Co. and has taken charge of the concern.

Lyford, Tex.—The installation of an electric plant is contemplated by the Stevenson Motor Co. A. W. Stevenson, president.

San Augustine, Tex.—The city contemplates the purchase of the electric light plant and will make improvements. Address the mayor.

Wichita Falls, Tex.—Wichita Falls Electric Co. has had plans prepared for the erection of large additions to its local generating station, including extensions in its transmission lines to a number of cities and towns. The entire work will cost in excess of $750,000.

WESTERN STATES.

Klemmer, Wyo.—The electrical equipment of the Cowry Coal Co. was destroyed by fire recently. Loss $10,000.

Ririe, Ida.—Utah Power & Light Co. has recently been issued an order by the Public Utilities Commission providing for the extension of its power lines to Ririe.

Mina, Nev.—P. A. Simon has made application to the state engineer for permission to use the water of East Walker river for generation of electric power. It is planned to create 6000 hp. by means of an impounding concrete and rock dam to cost approximately $600,000.

Hardin, Mont.—The Hardin electric plant has been sold by the Hardin Electric Co. to F. V. B. Collins, of Forsyth, Mont., at $35,000.

Missoula, Mont.—Missoula Light & Water Co. has completed arrangements for the remodeling of its power dam in the Missoula river, near Milltown. The work is estimated to cost $85,000. H. L. Bickenbach is in charge of the work.

Chehalis, Wash.—The city commissioner plans the establishment of a new street lighting system in the main business district. Resolutions for the improvements are being prepared.

Chehalis, Wash. — Washington-Idaho Light & Power Co. has filed a bill of sale conveying its Chehalis interests to the Sherman County Light & Power Co. of Oregon. A. Welch, Portland promoter, signed the papers as manager of the first named corporation. Last April the city voted the Welch company a franchise for a duplicate light and power plant here, but the option to operate under it has never been exercised.

Chehalis, Wash.—Property owners of the new street lighting district will be asked to petition for a new improvement district under the law, estimated cost of the change being $10,000, city to furnish the lights.

Hoquiam, Wash.—City commissioners have been petitioned by property owners to improve and extend the lighting systems on Eighth and I streets.

Seattle, Wash. — Thompson & Castleton are installing 600 hp. in motors for the Ferry-Baker Lumber Co. of Everett, Washington; also an electric crane. They are installing about 500 hp. in motors at the Everett Flouring mill, which is being remodeled.

Seattle, Wash.—The city council has appropriated $19,000 to buy motor trucks for the city light department,

and $20,000 to finance construction work.

Spokane, Wash.—County commissioners have awarded a contract to F. E. Martin for the immediate construction of a new power plant at the Edgecliff sanitarium. Estimated cost $21,000.

Bandon, Ore.—Plans are under consideration by the city hall for the early construction of a large new local electric plant to be used for municipal service.

Florence, Ore.—Fire recently completely destroyed the local electric plant operated by G. G. Bushman, Eugene, with total loss estimated at about $10,000. Plans are being arranged for immediate rebuilding.

Roseburg, Ore.—Mayor W. S. Hamilton has completed the location of a power site on the North Umpqua river above Rock Creek. Survey was made by Ford Frearer, city engineer. Location of the dam was placed above the larger falls. The plan contemplated by the mayor is to have the power to pump the city's water supply. The estimated cost of the plant contemplated is considerably less than $500,000, and it is believed the amount will be agreed upon by the voters.

Corcoran, Cal.—San Joaquin Light & Power Co. is having plans prepared for extensive improvements in its local electric system to cost about $80,000. Work will be inaugurated at an early date. J. B. Carter is manager.

Durham, Cal.—Pacific Gas & Electric Co. has recently been authorized to negotiate for the purchase of the plant of the Durham Light & Power Co. for a consideration of about $25,000. The plant is owned by J. A. and E. Foster, of Durham.

Los Angeles, Cal.—Fire recently damaged the local shops of the Pacific Electric Co. at Seventh and Alameda streets to the extent of approximately $150,000. It is understood that the company is considering plans for immediate rebuilding.

Los Angeles, Cal.—Electrical Products Corp. has purchased property on which it proposes to erect a new building. The structure will be of brick and steel construction and will cost approximately $30,000.

Modesto, Cal.—Following a resolution recently adopted jointly by the Modesto and Turlock irrigation district directors, a special election will be held for the purpose of voting on the issuance of bonds for $609,000, the proceeds to be used for the construction of a new power plant to have a capacity of about 40,000 hp., sufficient to handle the full capacity of the proposed Don Pedro dam.

Oroville, Cal.—Preliminary work has been inaugurated by the Great Western Power Co. on the construction of a new power line extending from Las Plumas to San Francisco.

Rio Vista, Cal.—Great Western Power Co. has had plans prepared for the immediate construction of a new 22,000-volt power line to extend from Hood to Franklin, with distributing lines to cover approximately twelve miles. Estimated cost $20,000.

PROPOSALS

Electrical Equipment.—Bids will be received by the town clerk of Gunniston, Miss., for 10 miles electric wiring with poles.

Welding Machine.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for one electric welding machine, for delivery at the Washington navy yard (Schedule 4588).

Press and Pumps.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids for one motor-driven washer press, delivery at Brooklyn navy yard (Schedule 4719), and 8 turbine-driven pumps, to be delivered at Brooklyn and Mare Island (Schedule 4586).

Electrical Equipment.—Bids will be received until Oct. 30 by Frank A. Vanderlip, 7 Wall street, New York, president of the board of managers, for the construction of eight cottages at the local institution, Letchworth Village, Thiells, N. Y. Considerable electrical equipment will be required in connection with this work.

Electrical Supplies.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for the following: 60 junction boxes; 3 telephone panels, 1 telephone switchboard, 16 switches, for delivery at Boston navy yard (Schedule 4744); 75,000 ft. cable, delivery at Brooklyn (Schedule 4684); 1604 ft. single-conductor cable, delivery at Philadelphia (Schedule 4728); searchlight carbons, delivery at eastern and western yards (Schedule 4660); steel conduit and fittings, delivery at Boston (Schedule 4746); electric cable, delivery at Boston (Schedule 4745), and turbogenerator sets, delivery at Puget Sound navy yard (Schedule 4855).

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Apparatus, Telephone, Telegraph and Alarm Service (30.853).—A business man in Norway desires to secure an agency for the sale of food products and kindred lines, textiles, dry goods, notions, men's and women's clothing, vehicles, leather, boots and shoes, chemicals, tobacco, building supplies, iron and steel, electrical apparatus, telephone, telegraph and alarm service, photographic supplies, rubber, rubber goods, etc. Quotations should be given c. i. f. Norwegian port. Payment through banks. References.

Motors, Cables, Etc. (30,858).—The president of an American trading corporation is soon to sail for the Balkan countries and desires to secure agencies for the sale of automobiles, marine motor boats, motors, agricultural machinery and implements, belting, boots and shoes, perfumery, mowing machines and blades, light motor plows, small electric motors, magnetos, machinists' tools, armored cables, steam engines, and boiler supplies. References.

Electrical Apparatus (30,870).—An organization for the construction of new hotels in a city of France proposes to construct in the near future a hotel of 420 rooms, and desires to get in touch with American firms interested in the export of interior furnishings, such as electric lighting, heating, plumbing, ventilation and sanitary appliances, kitchen equipment, refrigerators, laundry installation, washing and drying machinery, elevators, telephone installation and insulating material.

Power Plants (30,889).—An American consulting engineer located in Japan and acting as buyer for several Japanese dockyards, one steel works, and several government contractors, is prepared to receive catalogs, and prices from manufacturers with a view to establishing agencies for mining machinery, railway and dockyard equipment, power plants and machine tools. Reference.

Electrical Goods (30,891).—A commercial agent from Bolivia will be in the United States for the next few weeks for the purchase, from manufacturers only, of plumbing material and supplies, bathroom fixtures, hardware, tools, paints, zinc, tinware, tin, iron and steel goods, electrical goods and supplies, glass, hardwood flooring, medical and surgical instruments and appliances, tractors, agricultural machinery, paper and machinery for the manufacture of tile flooring. Correspondence should be in Spanish. References.

Electric Torches (30,899).—A municipality in Colombia is in the market for fire department equipment, such as canvas life chute, life nets, telescoping fire ladders, motor chemical engines, motor fire engine tender, gas and smoke masks, uniforms, helmets, fire gloves, etc., suction hose (armored), wheel-mounted hand fire pumps, stretchers, leather hose binders, firemen's tools in complete sets, hand oil lanterns, electric torches, chemical fire grenades, speaking trumpets and whistles. Quotations should cover an equipment for a city of 120,000. Correspondence should be in Spanish. Catalogs are requested.

Electrical Appliances (30,900).—A company in South Africa desires to secure agencies from manufacturers of glass tumblers, wide-mouthed glass fruit jars, domestic electrical appliances, such as cookers, toasters, irons and kitchen stoves. Payment, cash against documents in New York. Reference.

Wire and Wire Rope (30,910).—A firm in England desires to purchase wire and wire rope, specifications of which may be had on application to the Bureau or its district offices. Quotations should be given f. o. b. American port or c. i. f. English port. Payment, cash against documents through bank. Reference.

Personals

John B. Fisken New President of Northwest Association—E. C. White Manager Lighting Department Western Electric

ROBERT P. MCCARTY, formerly connected with the Knox Motors Co., Springfield, Mass., is now associated with the Electric Boat Co., Groton, Conn.

W. E. JONES, district manager for the Economy Fuse Manufacturing Co., Seattle, is visiting the distributing offices of the company at Salt Lake and Denver.

JOHN T. ELLIOTT, for the past 14 years associated with the Commonwealth Edison Co., Chicago, has resigned his position as assistant to chief engineer at Station 11 of the company, to become chief engineer of the Wisconsin Light, Heat & Power Co., Berlin, Wis.

CLARENCE J. BERRY, who for the last six years has been connected with the National Lamp Works of the General Electric Co., Cleveland, Ohio, has tendered his resignation to become associated with Brandt & Fouilleret, Paris, France, in the capacity of electrical engineer.

J. P. SCHROETER, for the past two years connected with the School of Engineering of Milwaukee, has accepted the appointment of designing engineer for the mechanical and electrical equipment of the new food plant to be erected by the Uihlein interests on Port Washington Road, North Milwaukee. The plant is being designed by A. W. Hoffman, 410 Berlin Arcade building, Milwaukee.

FREDERICK K. COPELAND, president of the Sullivan Machinery Co., Chicago, has been elected first vice-president of the Western Society of Engineers, succeeding Kempster B. Miller, resigned. Mr. Copeland was elected to membership in the organization in 1892, and since that time has zealously worked to promote the interests of the society. He is also chairman of the general committee of the Technical Societies of Chicago.

CHARLES E. WARWICK, superintendent of railway for the Eastern Wisconsin Electric Co., Sheboygan, Wis., has tendered his resignation and will remove to his former home at Hamilton, Ontario. Mr. Warwick entered the public service industry about 24 years ago and his experience in this field of activity has been quite varied, but devoting particular attention to the management of street railway and electric systems. His specialties in the work are the handling of transportation difficulties and the promotion of efficiency and safety for the public as well as the employes. He joined the Wisconsin company as superintendent of railway in May, 1918, and continued in this capacity until the present time. Mr. Warwick will be succeeded by Arthur Kolste, who has been serving the company as chief dispatcher.

FRANK M. EASTMAN has been appointed superintendent of the Montpelier & Barre Light & Power Co., Montpelier, Vt., succeeding Charles J. Cookson, who is now manager of the company.

IRVING E. TUTTLE, formerly associated with Meyer, Strong & Jones, consulting engineers, has become president of the Nate-Earle Co., New York, engineering contractor in power plants, heating and ventilating systems and piping of all descriptions.

E. CANTELO WHITE has been appointed manager of the electric lighting department of the Western Electric Co., New York. This department has recently been added to the general sales organization of the company for

E. Cantelo White.

the purpose of fostering the propaganda for better lighting in factories, offices, hotels, clubs and residences. Mr. White's experience in the electric lighting field covers a period of almost fifteen years, during which time his activities have covered both the United States and Canada as a salesman and designer of lighting equipment. Particularly in Canada, many of the most important lighting installations have been planned and sold by Mr. White and installed under his supervision. Mr. White is also well known to the electrical industry as the originator and designer of the "Duplexalite" line of lighting fixtures. In this connection Mr. White has done a great deal of standardization work and it will be his aim to carry on this standardization of lighting fixtures to such a degree that planning efficient lighting installation and merchandising the equipments will be greatly simplified.

C. C. WILCOX, until recently in the service of Hodenpyle, Hardy & Co., as assistant to consulting electrical engineer, has become chief engineer of the Durant Building Corp., Detroit, Mich.

FRED J. QUERIPEL, formerly with the Electric Furnace Construction Co., Philadelphia, as chief draftsman, is now engaged in plant engineering work for the National Aniline & Chemical Co., Marcus Hook, Pa.

R. E. BURGER has tendered his resignation as president and general manager of the Richland Public Service Co. of Ohio, to become chief engineer of Henry L. Doherty & Co., New York, public utility operators.

J. R. PERKINS has recently been appointed assistant to J. S. Pevear, general manager of the Birmingham Railway, Light & Power Co., Birmingham, Ala. Mr. Perkins is an engineer and an expert operating man who has been connected with the operating department of the American Cities Co. since 1913.

G. P. GOODMAN, for several years representative of the Hisey-Wolf Machine Co. in the East, has joined the staff of F. H. Niles & Co., Inc., and will take charge of their portable tool department. The latter company not only handles the Hisey-Wolf line of electric machine tools, but the Canton pneumatic hammers and drills manufactured by the Pittsburgh Pneumatic Co.

MISS M. GRACE BUXTON, who has been engaged in a secretarial capacity with the Westinghouse Electric & Manufacturing Co. and recently returned from its New York office, has been appointed registrar at the school of social work, Duquesne Unversity. While at the Pittsburgh offices of the company Miss Buxton was in charge of the commercial department of the vocational school for girls, conducted by the Westinghouse interests at Turtle Creek.

CHESTER A. GAUSS, until recently advertising manager of the Crocker-Wheeler Co., Ampere, N. J., has resigned his position with that company to become a partner in the newly formed firm of Robertson, Gauss & Co., engineering sales and advertising counsellors, with temporary offices at 59-61 Pearl street, New York. Mr. Gauss is a graduate electrical engineer with over seven years' experience in electrical advertising, sales investigation and promotion work and trade-paper editing. Among his former connections, before joining the Crocker-Wheeler Co., were the General Electric Co.'s publication department and the editorial staffs of the ELECTRICAL REVIEW and the *Electrical World*. Mr. Robertson has specialized for over eighteen years in the illustrating of mechanical products and in the printing of

engineering literature. The newly formed firm will specialize in engineering advertising accounts of all descriptions and formulate engineering sales-promotion plans for its clients.

GORDON CAMPBELL, president and general manager of the Edison Light & Power Co., York, Pa., was recently re-elected president of the Pennsylvania Railway Association. Mr. Campbell has been identified with the management of the activities of the association since December, 1916, first as a member of the executive committee, then as vice-president and as president since June, 1918. Prior to joining the York company in 1908 he was associated with public utilities in Denver, Colo., Newark, N. J., Providence, R. I. and Washington, D. C. He is also president and general manager of the York (Pa.) Railways.

COMMANDER FREDERICK G. SIMPSON has returned to civilian life and resumed his duties as vice-president and general manager of the Kilbourne & Clark Manufacturing Co., Seattle, Wash., manufacturer of radio apparatus. Early in the war he volunteered and was commissioned lieutenant-commander of the Boston navy yard, and shortly after was promoted and made district radio material officer with the rank of commander. He was later placed in charge of all radio material activity on the coast from Connecticut to Novia Scotia. Prior to entering the service Commander Simpson won renown as the inventor of the radio telegraph system now being produced by the Kilbourne & Clark Co.

R. H. RUTH has opened up a business in Rochester, N. Y., which will probably be known as the "Ruth Electric Shop," and will specialize on household electrical appliances. Mr. Ruth was for 15 years with the Benjamin Electric Manufacturing Co., working in contact with the New York office of the concern at 247 West 17th street, New York City, but in complete charge of the Pittsburgh territory. He has spent many years in traveling in western New York State and Pennsylvania, and his thorough acquaintance with the trade should stand him in good stead in his new business venture. Mr. Ruth has had large experience in merchandising electrical goods and his knowledge of household appliances, and lighting and wiring devices, should prove to be of great value in the business which he is entering.

JOHN B. FISKEN, chief engineer of the Washington Water Power Co., Spokane, Wash., who was elected president of the Northwest Electric Light & Power Association, at the annual convention held at Seattle in September, was born near Glasgow, Scotland, Nov. 2, 1861. He received early training in a private school, and after obtaining valuable experience in office work he took a four-years' course in the College of Science and Arts at Glasgow, and the City and Guilds of London Technical Institute course in electric lighting, graduating in 1886.

Soon after graduation, he came to the Pacific Northwest, engaging in electrical work in Seattle, Wash., and Victoria and Vancouver, B. C. He served as manager for the Victoria Electric Illuminating Co., and later supervised the installation of the lighting system in the C. P. railway hotel, then under construction at Vancouver. He has been a resident of Spokane since 1887, and during the years that have intervened he was engaged successively by the Spokane Falls Electric Lighting Co., by its successor, Edison Illuminating Co., then by the Spokane Street Railway Co. and the Washington Water Power Co., the last named having absorbed the other concerns. During a 12-months' interim in 1905-6, he was construction engineer for the Consumers Light & Power Co., and then reentered the employ of the Washington Water Power Co., and has continued his connection therewith since that date.

Mr. Fisken's work for the Washington Water Power Co. has comprised engineering, construction, maintenance and operation, affording a wide range of practical and technical experience. He was made chief engineer in June, 1918. His membership in the American Institute of Electrical Engineers began in 1903, and he assisted in organizing the Spokane section at a later date. For several years he has been a member of the Hydroelectric and Technical Committee of the Northwest Electric

John B. Fisken.

Light and Power Association. The presidency of that association, to which he has been elected, entitles him to a membership in the executive committee of the N. E. L. A. He is vice-president of the Employers' Association of the Inland Empire, and is a member of the University club of Spokane.

GEN. GEORGE H. HARRIES, after 27 months' active service in the Army, has returned to civil life and resumed his duties as vice-president of H. M. Byllesby & Co. in its eastern offices, 111 Broadway, New York. General Harries was released in August from the exacting duties which he filled in Berlin as the United States representative of the Inter-Allied Commission for the Repatriation of War Prisoners. With the American Expeditionary Forces General Harries for the third time served his country with distinguished success. As a boy his first military experience was received as a scout under Generals Miles and Crook in the Indian campaigns and so well did he grasp frontier problems that he was made a member of the Sioux Commission, having in charge the final adjustment of the differences with the Indians. In the Spanish War he led the First District of Columbia Volunteers as colonel, and was retired with the rank of brigadier general. He entered the Great War in command of three regiments of the Nebraska National Guard, brought them to war strength, at Deming, N. M., and after a short time at an Atlantic Coast port, sailed for France in command of a brigade, arriving early in 1918. His brigade was sent to the front near Verdun where it served gallantly. General Pershing, however, called upon General Harries for service as commandant of the port of Brest, where his organizing and executive ability established a record in the disembarkation of troops and the handling of both men and munitions.

When the armistice was declared General Harries, as assistant chief of staff to General Pershing, was a member of the Armistice Commission, and upon its conclusion was sent to Berlin, enjoying the distinction of being the ranking American officer first in the capital of the enemy. His position in Germany, having in charge the repatriation of war prisoners—American, Roumanians, Serbs and Russians—was one of extreme peril for months calling for the utmost resources of firmness and tact. The measure of success which rewarded his efforts is reflected by the following among other decorations: From General Pershing General Harries received the Distinguished Service Cross; from the French he received the rare distinction of the order commander of the Legion of Honor; the Russian government conferred upon him the order of St. Stanislaus; the Serbs, the order commander of the White Eagle; Italy made him a commander of St. Maurice and Greece presented him with the Grand Cross of George I. With all of his honors modestly borne, General Harries expresses unfeigned gladness to return to the field wherein he has long been prominent—the operation, engineering and financing of public utilities.

Obituary.

DAVID PERCY HARTZELL, Cumberland, Md., secretary and treasurer of the Cumberland & Westernport Electric Railway Co., died recently at his home at the age of 54 years. Mr. Hartzell was connected with the company for 14 years.

WILLIAM HARRINGTON ANDERSON, Brooklyn, N. Y., a well known electrical engineer and formerly connected with the Brooklyn Rapid Transit Co. and the Public Service Commission, died recently at the home of his parents, 1358 President street, at the age of 30 years.

WILLIAM SOFFE, vice-president of the Inland Electric Co., Chicago, Ill., died Oct. 10 after an illness of only a few days. Mr. Soffe was 32 years old and began his electrical career with the Illinois Electric Co., Chicago, remaining with that company until 1910, when he joined the sales organization of the Harter Manufacturing Co., Chicago. In 1917 he entered the employ of the Emergency Fleet Corp., acting as western buyer of supplies, and in February of this year became connected with the Inland Electric Co. Mr. Soffe was widely known in the electrical field and his many friends regret his untimely death.

For the Readjustment Period—What?

LV.

No Business Ever Succeeded Without Advertising

No—we will not back down on that statement—successful businesses have been built up without paying for advertising, but not without advertising.

We'll go farther and state, no man ever became prominent without some sort of advertising. Reputation of man or business is nothing but the advertisement of character, by loving friends or dear enemies.

So every one believes in advertising either consciously or unconsciously—because every one does it more or less successfully.

But the biggest, the most successful businesses, are those which invest real money in conscious, intelligent advertising.

The better the product or service the more important it is to thus advertise. It is the short cut—to national or local reputation. The carefully planned advertising campaign accomplishes in months results that would take years by the slow process of personal contact. We know this—and the biggest businesses in the country know it.

H. A. GROTH,
Secy. and Treas., Wm. H. Rankin Company.

In the accompanying statement Mr. Groth tells what every business man of experience knows, but often fights against. Why?

C. A. TUPPER *President*
INTERNATIONAL TRADE PRESS, INC., CHICAGO

Financial News

Commission Defines "Fair Value" in Lighting Rate Case.

In connection with a decision recently handed down by the Public Service Commission ordering the Mercersburg, Lehmasters & Markes Electric Co., Mercersburg, Pa., operating in Franklin county, to file a new schedule of rates following the sustaining of charges against the reasonableness of its rates for service, a statement on "fair value" is made. In its opinion the commission says:

"Each utility must be considered from the conditions surrounding it. The present property is used only because the owner was able to acquire it at a price far below its reproduction cost in its original form, and the commission is of the opinion that under the circumstances the purchase price, as fixed by the parties, plus the additions and improvements made since that time, substantially represents the fair value." It is held by the commission that a seven per cent return is fair compensation for service, while three per cent is allowed annually for depreciation, as well as a fair allowance for superintendence.

North American Light Status.

The North American Light & Power Co. has filed a statement showing its condition as of June 12, following its acquisition of the Southern Illinois Light & Power Co. The balance sheet shows a bonded debt of $6,333,000 and a floating debt of $364,548. There is $648,800 preferred stock and $775,000 common, also $862,600 of Southern Illinois Light & Power stock in the hands of the public. Net profit in 1918 was $621,532. For depreciation and amortization $148,120 was deduced, leaving $473,412. Interest charges were $356,243, leaving $117,169 applicable to dividends. There are now $2,478,000 underlying bonds, $2,755,000 first lien, and $1,350,000 of debentures. Interest on secured bonds is covered a little more than one and one-half times. Surplus covers the preferred dividend with a good margin, but this stock is preceded by a relatively large amount of securities and a small decrease in earnings would affect it severely.

Electric Company in Need of Increased Earnings.

Lamar Lyndon in his report on the status of the Houston Electric Co., estimates that to cover a 4½% depreciation and an income of 8%, it would be necessary for the company to have a net income of $542,000. It is said that in 1914 the company had a net income of $543,852, but that in the past two or three years the dividends have dwindled to $25,000.

In 1914 the company paid $202,000 in dividends. It is shown that the total revenue of the company has increased in ten years from $836,520 to an estimated total of $1,820,000 for 1919, and that the total expenses have increased during the same length of time from $488,220 to about $1,405,720. It is estimated the actual value of the plant is $4,000,000.

United Gas & Electric Note Issue.

United Gas & Electric Co., of New Albany and Jeffersonville, Ind., has petitioned the Indiana Public Service Commission to issue $300,000 of 6% gold notes, dated Sept. 1, and to mature Sept. 1, 1929, to sell at not less than 75% of their par value. The company will use proceeds of loan to refund its floating indebtedness.

Southern California Edison to Finance Extensions.

In a recent decision of the California Railroad Commission, the Southern California Edison Co. was authorized to issue and sell at not less than $90 per share net, 25,000 shares ($2,500,000) of its common capital stock. The proceeds of this sale will be used to finance the contemplated construction work to be carried out during the next three years, and will involve an expenditure of approximately $20,000,000. This program includes the building of a hydroelectric plant on Kern river, generating station at Big Creek, and general construction of substations, transformers, etc. The increased demand for power is responsible for the necessity of this construction work. Of the common stock $10,836,628 is controlled by the company through ownership of the Pacific Light & Power Corp., leaving net outstanding, $13,619,872.

Rochester Company to Vote Increased Capitalization.

Rochester Railway & Light Co. has called a special meeting of stockholders on Oct. 22, at the offices of the company, for the purpose of voting upon the proposed increase in the capitalization from $17,250,000 to $18,250,000, as well as to change the corporate name of the concern to the Rochester Gas & Electric Corp. James T. Hutchings is president; J. C. Collins, secretary.

DETROIT EDISON CO.
(Including all Constituent Companies.)

	Month of Aug., 1919.	Month of Aug., 1918.	8 months of 1919.	8 months of 1918.
Operating Revenue:				
Commercial electric revenue	$1,060,561.70	$ 878,725.89	$8,497,081.13	$7,183,598.30
Municipal electric revenue	29,307.17	27,316.91	229,210.40	210,361.03
Sales to street railways	88,907.36	70,512.91	635,216.82	564,883.95
Sales to other public service corp.	14,973.04	10,596.63	115,321.17	96,752.00
Miscellaneous revenue	564.50	199.62	5,005.45	22,638.41
Non-Operating Revenue:				
Steam sales	9,435.64	8,187.53	643,197.27	545,442.35
Other non-operating revenue	23,884.72	15,739.83	164,267.80	109,948.57
Total gross revenue	$1,227,634.13	$1,011,279.32	$10,289,300.04	$8,733,624.61
Expenses:				
Operating and non-operating (except renewal, replacement and contingent)	$ 909,712.01	$ 755,788.06	$7,054,738.94	$5,979,304.61
Renewal, replacement and contingent (depreciation reserve)	81,000.00	68,425.00	513,000.00	488,030.00
Total operating and non-operating expenses	$ 990,712.01	$ 824,213.06	$7,567,738.94	$6,467,334.61
Net income	$ 236,922.12	$ 187,066.26	$2,721,561.10	$2,266,290.00
Deductions from Income:				
Interest on funded and unfunded debt	$ 143,965.36	$ 121,430.83	$1,109,858.01	$ 838,876.27
Other deductions	.....	.....	.....	.....
Total deductions	$ 143,965.36	$ 121,430.83	$1,109,858.01	$ 838,876.27
Net	$ 92,956.76	$ 65,635.43	$1,611,703.09	$1,427,413.73

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities.	Div. rate. Per cent.	Bid Oct. 7.	Bid Oct. 14.
Adirondack Electric Power of Glens Falls, common	6	14	14
Adirondack Electric Power of Glens Falls, preferred	6	78	78
American Gas & Electric of New York, common	10+extra	127	127
American Gas & Electric of New York, preferred	6	40½	40
American Light & Traction of New York, common	..	220	230
American Light & Traction of New York, preferred	6	94	94
American Power & Light of New York, common	4	..	..
American Power & Light of New York, preferred	6	..	..
American Public Utilities of Grand Rapids, common	..	..	8
American Public Utilities of Grand Rapids, preferred	7	25	25
American Telephone & Telegraph of New York	..	99½	98⅞
American Water Works & Elec. of New York, common	..	4	5
American Water Works & Elec. of New York, particip.	7	20	20
American Water Works & Elec. of New York, first preferred	..	55½	58
Appalachian Power, common	..	4	3
Appalachian Power, preferred	7	25	21
Cities Service of New York, common	+extra	471	474
Cities Service of New York, preferred	6	76½	77½
Commonwealth Edison of Chicago	8	108	109½
Comm. Power, Railway & Light of Jackson, common	..	21½	21½
Comm. Power, Railway & Light of Jackson, preferred	6	49	48
Federal Light & Traction of New York, common	..	10	9
Federal Light & Traction of New York, preferred	..	58	45
Illinois Northern Utilities of Dixon	6	75	75
Middle West Utilities of Chicago, common	..	29	30
Middle West Utilities of Chicago, preferred	..	50	50
Northern States Power of Chicago, common	..	65	65
Northern States Power of Chicago, preferred	ex.div.7	90	89
Pacific Gas & Electric of San Francisco, common	..	66	66
Pacific Gas & Electric of San Francisco, preferred	6	89¾	90
Public Service of Northern Illinois, Chicago, common	7	85	85
Public Service of Northern Illinois, Chicago, preferred	6	91	91
Republic Railway & Light of Youngstown, common	4	9	11
Republic Railway & Light of Youngstown, preferred	6	45	45
Standard Gas & Electric of Chicago, common	..	31	31
Standard Gas & Electric of Chicago, preferred	8	40	40½
Tennessee Railway, Light & Power of Chattanooga, common	..	4	4
Tennessee Railway, Light & Power of Chattanooga, preferred	6	10	11
United Light & Railways of Grand Rapids, common	4	44	44
United Light & Railways of Grand Rapids, preferred	6	70	73
Western Power of San Francisco, common	..	23	23
Western Union Telegraph of New York	extra	83	84
Industries.			
Electric Storage of Philadelphia, common	4	119½	143
General Electric of Schenectady	8	165	166½
Westinghouse Electric & Mfg. of Pittsburgh, common	7	54¾	55¾